# Exhibit P

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## Dan Kikinis · 3rd
Chairman Of The Board at Liquineq AG

- OTOPY, INC.

- **ETH** ETH Zürich

Los Altos, California, United States · **Contact info**

**500+** connections

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## About

Approach:

Many varied experiences enable taking an unconventional view point, thus further improving the unique value of a venture.
Packaging of Intellectual Property into Innovation for creating added value beyond the service/products addressed

## Activity
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## Experience

OTOPY, INC.
20 yrs

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Chairman Of The Board at Liquineq AG

← **Experience**

**OTOPY, INC.**
20 yrs

**CTO Otopy**
2003 – Present · 20 yrs
Silicon Valley, USA

Otopy, Inc. is a silicon valley software company that has developed a next-generation AI search technology. The technology is applicable to a wide variety of applications. Currently the software is being used by the US Intelligence Community. Otopy is currently working with Stanford Medical Research to help solve big medical problems like Alzheimer's, and the larger issue of diabetes and insulin resistance. Once this is deployed it could be applied to other chronic disease such as other types of dementia, or other neurological chronic disease such as Parkinson's. The results could then be used to develop other cures using personalized medicine. This application has the potential to become a game changer in the medical field.

**CTO**
Dec 2003 – Present · 19 yrs 1 mo
San Francisco Bay Area

- developed Medical Industry architecture 2018
- deployed eCommerce solution on AWS 2017
- prepare for AWS data lake service delivery 2017
- AWS delivery planned and implemented 2016
- mobile devices behavior and failure analytic system (NTF reduction) designed and implemented
- u-Gram based indexing and search technology
- Big Data Analytics capabilities for very large indices and fanout reduction
- for very large, unstructured, semi-structured and structured data sets with drag and drop data connectivity
- cloud based, both Hadoop and VMware
- Otopy also offers block-chain enhanced architecture to provide an extra layer of security and fine granularity privacy control for customers data
- up to 100x more efficient than conventional search systems in terms of time, equipment and energy use

Today's digital universe (the internet, your personal data, corporate data and government data) is a wild,...

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**Liquineq**
6 yrs

**Chairman Of The Board**

2017 - Present · 6 yrs
Switzerland

Liquineq™ is a FinTech solution based on a permissioned Multitier Blockchain financial platform optimized to address the flaws in the existing banking system as well as new challenges posed by slow blockchain performance, revocation/redemption of tokens that are stolen or lost and the ability to easily use Liquideum tokens as fiat currency, as well as compliance problems of most cryptocurrencies and many blockchain solutions.

**Liquineq**
Short overview - more on our website at
https://www.liquineq.ch

**Chief Executive Officer and CO-Founder**

2017 - Jun 2018 · 1 yr 6 mos
Zug, Switzerland

Liquineq is a blockchain based international startup with a patent-pending solution that provides a unique and powerful infrastructure and commercial solution for that enables cryptocurrency for the masses. Stay tuned.... it's going to be an interesting ride!

**Liquineq**
The Liquineq™ Opportunity There are elements with 1st and 2nd generation cryptocurrency solutions that...
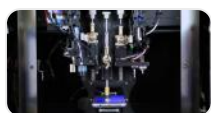
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**CTO**
FutureDial

2011 - Present · 12 yrs
San Francisco Bay Area

The better solution...FutureDial offers a wide range of software solutions for mobile device and content management, device logistics and customization, as well as Cloud-based services and applications, as well as diagnostics and device fault analytics.

**The Future Dial Solution**
FutureDial provides leading device processing solutions for the mobile device supply chain. Our...

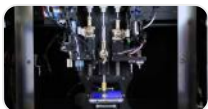solutions for the mobile device supply chain. Our...

**The Future Dial Solution**
FutureDial provides leading device processing solutions for the mobile device supply chain. Our...

### President
Lextron Systems, Inc.
1996 - Present · 27 yrs

- System Design and Intellectual Property consulting services
- Devise strategy and help implement for IP extraction and IP packaging
- Enhance system architecures for telecom, computing, software and Internet systems as result of IP strategy
- Support of implementation and processing of IP in conjunction with counsel
- novel, cost effective approach results in greater efficiency of IP processes, both patent and non patent

### Advisor
Silicom Ventures
2000 - Dec 2016 · 17 yrs

Advisor on Internet, Telecom and other technologies, and IP, of course

### Advisor
SRII Global
Dec 2012 - Oct 2016 · 3 yrs 11 mos
Silicon Valley, CA

Advisor for Big Data Search and other fields of expertise

http://thesrii.org/

### CTO
Cimbal
Jan 2011 - Nov 2015 · 4 yrs 11 mos

- Very fresh approach to secure mobile payments and loyalty programs
- Does not require special hardware on either the device nor the point of business
- allows Level 3 transactions on all type of tender
- multi tender multi vendor wallet
- integrated loyalty programs

### IP Consultant
Exigen Group
Jun 2001 - Jul 2010 · 9 yrs 2 mos

### Advisor
Twiki, Inc.
2008 – 2010 · 2 yrs

### IP Consultant
Genesys Telecommunications Laboratories
1997 – 2007 · 10 yrs
San Francsico

Helped manage IP extraction and push into new areas in Computer Telephony and Call Center Management

### iSurfTV
3 yrs 7 mos

### Chief Intellectual Property Officer
Jul 2001 – Jul 2003 · 2 yrs 1 mo

Create non infringment product stragey and protect resulting innovation in interactive television field

### CIPO
2000 – 2003 · 3 yrs

### Consultant Technology and IP
Mobilewise
2000 – 2002 · 2 yrs
Palo Alto

Help develop new technologies and IP portfolio to cover them. Key approaches for Mobile wirefree power delivery, both contact and contact free systems.

### President & CEO
Elonex Technologies
1992 – 1995 · 3 yrs
Silicon Valley

Managed R&D group and global manufacturing with sites in Cumbernauld, Scotland and Hsinsu, Taiwan. Developed IP portfolio, later widely licensed for power management of computing systems and attached peripherals, as well as additional PC related enhancements. Developed also first sub inch color notebook in 1993 with built in primary power supply.

**Alex Feerer** • 3rd
Founder Chairman of the board at GLES R&D Corp

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**H. John Lahlouh** • 3rd+
CEO & Chairman of the board

🔒 Message

**Anthony Tang** • 3rd+  in
Vice Chairman Of The Board at Cathay Bank

👤+ Connect

**Chairman Of the Board** • 3rd+
Chairman Of The Board at Karate Combat

👤+ Connect

**PETER DOERKEN** • 3rd
Chairman of the Board at DPI Retail LLC and Founder/CEO of The Peter W.
Doerken Foundation

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← **Patents**

### Pre-boot operating environment
US 8,560,822 · Issued Oct 15, 2013

See patent

Approaches for a pre-boot operating environment. A BIOS, executing on a machine, is configured to execute a program prior to booting an operating system executing on the machine. Prior to loading an operating system on the machine, the program executes to establish a pre-boot operating environment. The pre-boot operating environment may support the execution of one or more application therein. The pre-boot operating environment may be a Linux-style or Unix-style operating environment.

One or more tangible machine-readable mediums storing one or more sequences of instructions, which when executed, cause: a EFI, executing on a machine, providing a pre-boot operating environment that displays one or more advertisements while the EFI loads an operating system on the machine; the EFI, during the loading of the operating system, receiving input from a user that indicates interest in an item in the one or more advertisements; the EFI storing bookmark data to evidence that the user sent the input for the item; after loading the operating system, consulting the bookmark data and providing an interface to allow the user to purchase or license the item; the BIOS communicating with an external server over a wireless network to determine if an update to the one or more advertisements is available; and upon the EFI determining that the update to the one or more advertisements is available, the EFI receiving, over the wireless network, the update to the one or more advertisements.

**Other inventors**

### Method and apparatus for virtual editing of multimedia presentations
US 8,527,880 · Issued Sep 3, 2013

See patent

A method and apparatus for viewing desired portions of a multimedia presentation. Desired portions of a multimedia presentation are determined. In one embodiment, an editor may determine which portions of the presentation are

based upon the determined desired portions of the multimedia presentation. The annotation file contains pointers corresponding to the desired portions of the multimedia presentation. Annotation management software may be use the annotation file to cause a display device to display only desired portions of the presentation. The annotation file may be applied to a broadcast presentation or a recorded program file. In one embodiment the annotation file may contain information related to the desired portions of the multimedia presentation and/or the remainder of the multimedia presentation.

A method comprising: identifying a plurality of desired portions of a content item; automatically creating, by a computing device having at least one processor, annotations for the content item, wherein automatically creating the annotations includes: storing a first identifier corresponding to a first desired portion of the plurality of desired portions and a second identifier corresponding to a second desired portion of the plurality of desired portions in the annotations, wherein the first desired portion and the second desired portion are separated in the content item by an intervening portion, and storing displayable content information describing a non-identified portion of the content item; and generating, by the computing device, a display of the displayable content information describing the non-identified portion of the content item without displaying the non-identified portion.

**Other inventors**



### System and method for insertion of recorded media into a broadcast

US 8,522,266 · Issued Aug 27, 2013

See patent

A system and method for prioritizing the insertion of recorded media into a broadcast stream according to a comparison of priority indicators in the broadcast stream and in the recorded media insertion. The recorded media insertion may be multi-media in nature.

A set-top box, comprising: A memory storing computer readable instructions that, when executed, cause the set top box to: receive a broadcast stream, a portion of the broadcast stream having a first priority indicator; receive media separate from the broadcast stream, the media having a second priority indicator; determine whether the first priority indicator is greater than the second priority indicator prior to receiving a signal configured to modify the first priority indicator from a first priority to a second priority; in response to determining that the first priority indicator is greater than the second priority indicator, delay insertion of the separate media into the broadcast stream until the first priority indicator is modified; receive the signal configured to modify the first priority indicator from the first priority to the second priority; modify the first priority indicator from the first priority to the second priority in response to receiving the signal; determine whether the modified first priority indicator is lower than the second priority indicator; and replace the portion of the broadcast stream with the separate

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                                            Home   My Network   Jobs      Me

**Other inventors**

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### Simulcast web page delivery

US 8,468,215 · Issued Jun 18, 2013

See patent

A multimedia system provides program schedule information simulcast as a data stream (e.g., HTML) including commands and displayable, selectable indicia associated with the commands, along with programs for display. A device may be adapted to separate the HTML data stream and to store that data in a cache as pages (e.g., web pages) retrievable by a browser in the device, whereupon the program schedule information is displayed including the displayable, selectable indicia. Selecting the indicia directs the device via the associated command to receive and display a program associated with the displayable indicia. The indicia may be any text, icon, dynamic figurine, and the like. In one example, program schedule pages, including the commands and displayable indicia, are stored and marked on a server coupled to the Internet and to a scanner adapted to scan the server for marked pages, and to upload the marked pages to a transmission system.

A method comprising: receiving, by a computing device, programming information for future content from one or more content sources, wherein the programming information includes a page mark and wherein the page mark is used to identify pages for transmission to a destination device; and identifying, by the computing device, one or more pages specified by the page mark, wherein the one or more pages are configured to cause the destination device to perform one or more functions.

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### Method and system for 3-D enhanced advertising for TV broadcast of 2-D video

US 8,438,594 · Issued May 7, 2013

A method and system for 3-D enhanced advertising for TV broadcast of 2-D video is disclosed. In one embodiment, a method for providing enhanced advertising of a 2-D video broadcast, comprises receiving the 2-D video broadcast containing a 2-D advertisement having an image. The image is identified within the advertisement. A matching 3-D object in an image library is used; wherein the library comprises one or more 3-D objects. The matching 3-D object is used to generate an advertisement, wherein the advertisement has a 3-D highlighted rendering of the image.

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### Systems and methods for prevention of open loop damage during or immediately after manufacturing

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                       Home    My Network      Jobs

A solar cell having an open loop voltage that approaches a critical voltage range
when exposed to light. A circuit, connected to the solar cell, is configured to load
the solar cell when the open loop voltage of the solar cell reaches a threshold
within a predetermined range of the critical voltage range.

**Other inventors**

### Enhanced battery storage and recovery energy systems

US 8,405,349 · Issued Mar 26, 2013

See patent

Systems and methods are herein disclosed for efficiently and cost-effectively
balancing the voltages across batteries and/or cells in an energy storage system.
A controller monitors the battery voltages and instructs regulator circuits to
balance voltages between any batteries or sets of batteries having imbalanced
voltages. Regulator circuits implementing a modified uk converter can be utilized.
Regulator circuits can have two capacitive circuits, one inductive circuit, and two
switches. Two capacitors, an inductor, and two field effect transistors can be
used in each regulator circuit.

**Other inventors**

single application of keys

US 8,341,676 · Issued Dec 25, 2012

See patent

A method and system for performing an alphabetic search using a single application of keys is disclosed. In one embodiment, a method for selecting a program title using an alpha-numeric keypad, comprises gathering one or more searchable items from a broadcast source; generating a dynamic directory of the one or more searchable items by a set-top box; narrowing the scope of the dynamic directory upon receiving a narrowing command from the keypad; receiving a partial program title from the keypad at the set-top box; returning a list of possible selections by the set-top box, wherein the list includes the program title; and receiving a subselector key selector signal from the keypad at the set-top box, wherein the subselector key selector signal selects the program title.

### Universal programming system and method for EPG with localized interactive content

US 8,132,207 · Issued Mar 6, 2012

See patent

An EPG to display programming information in a variety of ways including using 3-D images, alphanumeric text, and video data. In addition, non-EPG objects, such as interaction objects, may be conflated with the presentation of the world and with the program schedule information. A communication module in the EPG receives localized content containing multiple objects from one or more servers coupled to a network. Users may interact with the content (e.g., buy and sell goods and services from local franchises) through a user-interface coupled to the EPG.

**Other inventors**

### Telephone network interface bridge between data telephony networks and dedicated connection telephony networks

US 8,130,749 · Issued Mar 6, 2012

See patent

A computerized telephony bridge unit has a Data Network Telephony (DNT) Port and a Connection Oriented/Switched Telephony (COST) trunk port, each associated with circuitry for receiving a placing calls in the data format required by connected networks. The bridge unit further comprises conversion circuitry for

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are adapted to receive a first call from one of the COST and DNT networks, to place a call associated with the received call on the network other than the network on which the call is received, and to dynamically convert data between a call connected at one port and a call connected at the other port. The data network can be the Internet, and the COST network can be any publicly or privately switched dedicated-connection-oriented telephone network. Association between calls between two otherwise incompatible networks can be by a locally-stored lookup table, by negotiation with a caller, or by retrieval of data from incoming calls. Methods for practicing the invention are taught in the disclosure.

### Method and system for identifying addressing data within a television presentation

US 8,130,320 · Issued Mar 6, 2012

See patent

Characters represented within a frame of a television presentation are identified. A pattern formed by a subset of the characters is identified if the pattern is indicative of an addressing datum. A provision is made for a selection of characters that form the pattern indicative of the addressing datum. In one embodiment, a web page is displayed upon a selection of characters that form a pattern indicative of a uniform resource locator for the web page.

### Simulcast web page delivery

US 8,108,487 · Issued Jan 31, 2012

See patent

A multimedia broadcast system provides program schedule information simulcast as a Hyper Text Markup Language (HTML) data stream including commands and displayable, selectable indicia associated with the commands, along with programs for display. A set top box is adapted to separate the HTML data stream and to store that data in a cache as WEB pages retrievable by a WEB browser in the set top box, whereupon the program schedule information is displayed including the displayable, selectable indicia. Selecting the indicia directs the set top box via the associated command to tune to a program associated with the displayable indicia. The indicia may be any text, icon, dynamic figurine, and the like. In a preferred embodiment program schedule WEB pages, including the commands and displayable indicia, are stored especially marked on a WEB server coupled to the Internet and to a scanner adapted to scan the WEB server for marked pages, and to upload the marked pages to a satellite broadcast system.

### Universal programming system and method for electronic programming guide

US 8,104,061 · Issued Jan 24, 2012

An EPG displays programming information in a variety of ways including using 3-D images, alphanumeric text, and video data. A presentation engine allows viewers and/or programmers to select between varying programming worlds. In addition, non-EPG objects, such as interaction objects, may be conflated with the presentation of the world and with the program schedule information.

### Method and apparatus for virtual editing of multimedia presentations

US 8,078,967 · Issued Dec 13, 2011

See patent

A method and apparatus for viewing desired portions of a multimedia presentation. Desired portions of a multimedia presentation are determined. In one embodiment, an editor may determine which portions of the presentation are desired. Alternatively, or additionally, specified criteria may be applied to the presentation to determine the desired portions. An annotation file is then created based upon the determine desired portions of the multimedia presentation. The annotation file contains pointers corresponding to the desired potions of the multimedia presentation. Annotation management software may use the annotation file to cause a display device to display only desired portions of the multimedia presentation. The annotation file may be applied to a broadcast presentation or a recorded program file. In one embodiment the annotation file may contain information related to the desired portions of the multimedia presentation and/or the remainder of the multimedia presentation.

### System and method for prevention of open loop damage during or immediately after manufacturing

US 8,039,730 · Issued Oct 18, 2011

See patent

A solar cell having an open loop voltage that approaches a critical voltage range when exposed to light. A circuit, connected to the solar cell, is configured to load the solar cell when the open loop voltage of the solar cell reaches a threshold within a predetermined range of the critical voltage range.

**Other inventors**



### Using XML expressed primitives for platform and system-independent call modeling

US 8,018,921 · Issued Sep 13, 2011

A system for providing third-party call control in a telecommunications environment is provided. The system comprises, a call-control mechanism for providing service logic and routing intelligence, a control application for providing service-logic description and command instruction for implementing third-party controlled call connections, a call-switching mechanism for providing an abstract state of switching matrix and for commutation of external and internal call legs and a commutation application for making and breaking call connections according to commands sent from the control application. The call-control mechanism, using the control application, sends primitive text commands to the call-switching mechanism, which utilizing the commutation application, receives, reads and implements the text commands containing all of the service logic and instructions required to successfully construct call connections and wherein the call-switching mechanism by virtue of the commutation application sends notification of success or failure regarding implementation of received commands back to the control application.

**Other inventors**

**System for facilitating parallel data transfer from a wireless caller into a communications center**
US 8,010,092 · Issued Aug 30, 2011

See patent

A system for identifying and interacting with callers has: a telephone switch for receiving and distributing incoming calls; a messaging server for sending or receiving messages and attachments; and, a software routine for identifying wireless callers and for matching them to messages in the messaging server. The system is characterized in that upon receiving a call the system attempts to identify the call to a caller and of the caller is not already known in the system or identified an automated message is generated and sent to the caller asking for the desired information. In one embodiment the caller sends a message when the call is placed to optimize identification.

**Other inventors**

**Perpendicular view three dimensional electronic programming guide**
US 7,975,399 · Issued Jul 12, 2011

See patent

which independent objects representing television programs are situated. The virtual mesh is displayed perpendicularly, so that the hardware requirements of the set top box (STB) may be reduced. A user can navigate the mesh to find television programs that they wish to view. A user can designate the types of television programs that they prefer, and these programs will be displayed more prominently. In addition, the mesh is constructed of at least two planes. The first plane is flat, while all other planes are hyperbolic to correct for a viewer's line of sight.

### Methods and apparatus for enhancing wireless data network telephony including a personal router in a client

US 7,965,742 · Issued Jun 21, 2011

See patent

A data network telephony (DNT) wireless communication system has a base station connected to a DNT-capable data network and to a plurality of wireless transceivers, each transceiver transmitting to a distinct area, the base station adapted to operate the transceivers by a two-way, narrow-band, multiple-channel, real-time duplex radio protocol, and a plurality of portable computer-enhanced client communicator units, including microphone and speaker apparatus, each assigned a unique address and adapted to communicate with the base station via the transceivers by the two-way real-time radio protocol and to process DNT calls. The wireless system operates as a carrier-sense multiple access system with collision detection (CSMA/CD).

### Customer self service in interactive TV environment for TV programming packages

US 7,958,533 · Issued Jun 7, 2011

See patent

Method and system for enabling users to perform self-service operations in interactive TV environments. In one embodiment, the method enables users to select and activate programming packages via a set-top box, thereby eliminating the need for the users to have to call a call center to activate the unit. Using a set of interactive screens, the user is enabled to view various programming package information, including comparative information. In one embodiment, the method assists users who are moving to activate/reactive broadcast services. For example, options are provided to enable the user to schedule service work, disconnect and activate services, and other activities connected with the move. In another embodiment, the method enables a user to select a programming package based on packages that are recommended by the system. Historic usage patterns, including viewing habits and attempts to access unavailable content are analyzed to determine which programming packages should be recommended for the user.

### Enhanced home entertainment system with removable long-term storage

US 7,886,330 · Issued Feb 8, 2011

See patent

A method and apparatus for set top box (STB) receiving a single selection or actuation, and in response to a single selection from a user, transferring a program and auxiliary data related to the program from a first storage device of the STB to a removable storage device.

### Apparatuses and methods to reduce safety risks associated with photovoltaic systems

US 7,884,278 · Issued Feb 8, 2011

See patent

Apparatuses and methods to reduce safety risks associated with photovoltaic systems by providing a safety switch on a photovoltaic panel. In one embodiment, a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

**Other inventors**

### ystem for controlling processing of data passing through network gateway between two disparate communications networks

US RE42,042 · Issued Jan 18, 2011

See patent

A control system is provided for controlling the aspects of data conversion and routing of data passing between two disparate communications networks. The system operates from a network-connected computer node running a software application. The computer node acquires the data protocol associated with the data en-route from one network to another and using the software application, formulates the required conversion commands and routing instructions based on

next network. The conversion nodes apply the commands routed to them by the computer node to the appropriate data passing through the nodes. In one application, the control system combines the total hardware and software functions of the computer node and the conversion nodes and is provided to operate from one network-connected node.

### Methods and apparatus for enhancing wireless data network telephony, including quality of service monitoring and control

US 7,852,830 · Issued Dec 14, 2010

See patent

A system for wireless communication comprises an architecture of routers connected to a network and having connected transceivers for wireless transmission and reception of data, and a plurality of hand-held communicators adapted for users to communicate with the network through the routers. The system is adapted to provide wireless Data Network Telephony (DNT), and the hand-held communicators execute Quality of Service (QoS) code adapted to prioritize DNT packet code over all non-DNT traffic, thereby preserving the real-time nature of the DNT code.

### Simulcast web page delivery

UG 7,836,149 · Issued Nov 16, 2010

See patent

A multimedia broadcast system provides program schedule information simulcast as a Hyper Text Markup Language (HTML) data stream including commands and displayable, selectable indicia associated with the commands, along with programs for display. A set top box is adapted to separate the HTML data stream and to store that data in a cache as WEB pages retrievable by a WEB browser in the set top box, whereupon the program schedule information is displayed including the displayable, selectable indicia. Selecting the indicia directs the set top box via the associated command to tune to a program associated with the displayable indicia. The indicia may be any text, icon, dynamic figurine, and the like. In a preferred embodiment program schedule WEB pages, including the commands and displayable indicia, are stored especially marked on a WEB server coupled to the Internet and to a scanner adapted to scan the WEB server for marked pages, and to upload the marked pages to a satellite broadcast system.

### Apparatuses and methods to reduce safety risks associated with photovoltaic systems

US 7,807,919 · Issued Oct 5, 2010

See patent

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a photovoltaic panel includes: at least one photovoltaic cell; a connector to output energy from the photovoltaic panel; and a switch coupled between the at least one photovoltaic cell and the connector. The switch is configured to disconnect the at least one photovoltaic cell from the connector during installation of the photovoltaic panel, and to connect the at least one photovoltaic cell with the connector after installation of the photovoltaic panel.

**Other inventors**

## System for distributing VXML capabilities for execution on client devices

US 7,792,254 · Issued Sep 7, 2010

See patent

A system for interacting with voice extensible markup language application content includes a content source node connected to a network for rendering availability of voice extensible markup language content and code; a communication device connected to the network for acquiring at least the code rendered available; and a software interface running on the communication device for determining local existence of at least the code acquired and initializing execution of found code. Upon code execution, the content may be played on the communication device without a persistent network connection to the enterprise hosting the content.

**Other inventors**

+2

## E-mail client with programmable address attributes

US 7,716,292 · Issued May 11, 2010

See patent

An e-mail processing application executable on a computer station having a video display unit (VDU) searches a received e-mail for one or more words, phrases, and addresses for comparison with stored words, phrases and addresses in a stored table, and upon finding a match in the stored table, inserts one or more of words, phrases, or addresses associated in the stored table with the words, phrases or addresses from the received e-mail in any reply to the received e-mail. In a preferred embodiment a "send to" address in a received e-mail triggers automatically one or both of a particular "from" and "reply to" address in any response to the received e-mail. In an alternative embodiment, a "send to"

to address retrieved from the stored table. In alternative embodiments the application simply provides variable fields in a reply window for a user to enter variable "from" and "reply to" addresses.

### Customer self service in interactive TV environment for TV programming

US 7,703,119 · Issued Apr 20, 2010

See patent

Method and system for enabling users to perform self-service operations in interactive TV environments. In one embodiment, the method enables users to select and activate programming packages via a set-top box, thereby eliminating the need for the users to have to call a call center to activate the unit. Using a set of interactive screens, the user is enabled to view various programming package information, including comparative information. In one embodiment, the method assists users who are moving to activate/reactive broadcast services. For example, options are provided to enable the user to schedule service work, disconnect and activate services, and other activities connected with the move. In another embodiment, the method enables a user to select a programming package based on packages that are recommended by the system. Historic usage patterns, including viewing habits and attempts to access unavailable content are analyzed to determine which programming packages should be recommended for the user.

**Other inventors**

### Method and apparatus for notifying users of interactive functions using a remote device

US 7,698,727 · Issued Apr 13, 2010

See patent

A method and apparatus for notifying a user of an interactive event using a remote control device. In one embodiment, a remote control device contains either a display or a bright light, or both, which can create a visual alert to let a user know that an interactive function is available. The nature of the function may be displayed on a screen attached to the remote control device.

**Other inventors**

### Three dimensional light electronic programming guide

Home

My Network

Jobs

Me

A method and apparatus of displaying an Electronic Programming Guide (EPG). In one embodiment, an EPG is displayed in a three dimensional virtual mesh, in which independent objects representing television programs are situated. The simplified nature of the three dimensional EPG reduces the amount of processing necessary to display it. In addition, the virtual mesh may be displayed isometrically, so that hardware requirements are further reduced and it may be possible to use a software only three dimensional graphics pipeline. If a user has a set top box (STB) with a hardware accelerated graphics pipeline, the EPG may be displayed in a full three dimensional perspective view. A user can navigate the mesh to find television programs that they wish to view. A user can assign values to types of television programs that they prefer, and these programs will be displayed more prominently.

## Simplified-file hyper text protocol

US 7,562,157 · Issued Jul 14, 2009

See patent

A system is provided wherein relatively low-end computers, such as portable, battery-powered computers ordinarily incapable of sophisticated Internet browsing functions may be used to browse the Internet. The enhanced computing ability for such portables is provided by a unique Internet server adapted for transposing data files to alternative, low-information-density form, preferably comprising simplified or single files suitable for rapid processing and display by connected portable and other low-end computers In embodiments wherein batter-powered field units are used, battery life is exhibited far beyond what would be expected for a battery-powered computer with computing power for browsing the Internet directly. In some embodiments of the invention adapted files are saved and identified for future use in communicating with specific devices over Internet connections.

## Embedded WEB phone module

US 7,522,582 · Issued Apr 21, 2009

See patent

A system for enabling Data Network Telephony (DNT) communication through a WEB page includes a Web server hosting an interactive WEB page and having an Internet port, a link in the WEB page adapted for launching a DNT-capable telephone module, and a DNT-capable telephone module associated with the link. In this system, upon selection of the link by a person accessing the WEB page over the Internet using a computer platform, an instance of the IP telephone module is downloaded to computer platform, and an IP call is launched to an IP address pre-stored and associated with the link. The DNT network may be the Internet. In a preferred embodiment the system first investigates the computer

downloaded module then self-launches and configures, and then launches the associated call. In some embodiments the module disappears after a single call, and thus serves as an instant enabler for IP telephony.

### Universal programming system and method for electronic programming guide

US 7,516,469 · Issued Apr 7, 2009

See patent

An EPG displays programming information in a variety of ways including using 3-D images, alphanumeric text, and video data. A presentation engine allows viewers and/or programmers to select between varying programming worlds. In addition, non-EPG objects, such as interaction objects, may be conflated with the presentation of the world and with the program schedule information.

### Networking integration of wire-free electric power surface

US 7,474,875 · Issued Jan 6, 2009

See patent

An apparatus including surface that includes a set of contact points, the surface to provide a medium to transmit data between a first device in contact with one or more contact points of the surface, and a second device in contact with one or more contact points of the surface. In one embodiment, the surface is to provide a medium to non-aerial wirelessly transmit data between the first and second device. In one embodiment, at least one of the first and second devices are exclusive of aerial wireless data transmission capabilities. In one embodiment, the surface is to provide a medium to transmit data between the device and a third device separated from the surface.

**Other inventors**

### Method and system for identifying addressing data within a television presentation

US 7,456,902 · Issued Nov 25, 2008

See patent

Characters represented within a frame of a television presentation are identified. A pattern formed by a subset of the characters is identified if the pattern is indicative of an addressing datum. A provision is made for a selection of characters that form the pattern indicative of the addressing datum. In one

**Method and system for enabling visitors to subscribe to currently viewed programming package**

US 7,412,716 · Issued Aug 12, 2008

See patent

Methods and systems for enabling users visiting a friend or family member to subscribe to a TV programming package that the friend or family member currently subscribes to. In one embodiment, the method includes generating a user-interface (UI) via the friend's set-top box to enable entry of visitor user identification information. This information, along with programming identification information is then sent to the service provider for the programming package. The service provider retrieves or generates information by which a UI may be generated to easily enable the visitor to setup and activate the programming package and sends it to the visitor's home set-top box. In another embodiment, programming package identification information is stored on a portable storage medium and carried to the visitor's home set-top box, where it is read to retrieve the identification information. The information is then sent to the service provider, which sends back appropriate data to generate the UI.

**Other inventors**

**Customizable media player with online/offline capabilities**

US 7,412,484 · Issued Aug 12, 2008

See patent

An information dissemination system comprises an Internet-connected server adapted for gathering information from plural sources, and sorting the information according to subscriber preferences. The sorted information is transmitted via the Internet to a subscriber's Internet Appliance (IA) as electronic documents, where the documents are downloaded to a connected playback device. The playback device may be disconnected from the PC, and the information electronic documents rendered as speech to a speaker in the playback device by a text-to-speech system. In a preferred embodiment annotation is added at the Internet-connected server to control speech characteristics, such as inflection, upon playback. In some embodiments updates may be made by radio with the playback device disconnected from the IA.

**Wirefree mobile device power supply method & system with free positioning**

US 7,399,202 · Issued Jul 15, 2008

See patent

circuit between the contactor device and an adaptor device when the adaptor device is brought into physical contact with the contactor device, there being no need for aligning for the electrical contacts of the contactor device with electrical contact of the adaptor device.

**Other inventors**

### Alternative wirefree mobile device power supply method and system with free positioning

US 7,392,068 · Issued Jun 24, 2008

See patent

The invention provides a power delivery system for a mobile device. The power delivery system includes a contactor device and a plurality of first electrical contacts on the contactor device disposed in an interspersed arrangement wherein first electrical contacts of one polarity are interspersed with first electrical contacts of a second polarity throughout the contactor body.

**Other inventors**

### Method and system for inserting a new channel into a list of preferred channels

US 7,389,523 · Issued Jun 17, 2008

See patent

A first set of channels is provided. The first set of channels is selected based on a predetermined criteria related to a viewing preference of a viewer. A first channel not selected based on the predetermined criteria related to the viewing preference of the viewer is inserted into the first set of channels. In one embodiment, a system operator inserts the first channel into the first set of channels. In one embodiment, insertion is disallowed if a number of channels not selected based on the predetermined criteria related to the viewing preference of the viewer that have been inserted into the first set of channels is greater than a predetermined number.

### Freezing live video frames with interactive links

US 7,386,875 · Issued Jun 10, 2008

An embodiment of the present invention allows a user to maintain the display of a video frame containing one or more interactive links while also maintaining access to the links. Thus allowing the user to select and examine any desired links at his own pace. For one embodiment, the display of a video frame is maintained by interrupting the refreshing of the frame buffer and the interactive link stream. Interrupting both the frame buffer refresh and the interactive link stream refresh results in the frame being "frozen" along with its associated links. For one embodiment, pressing a button on a control device effects the interruption of the frame buffer refresh and the interactive link refresh. The button may toggle to resume the video display. Alternatively, or additionally, the video display may resume if no action is taken in regard to the interactive links within an specified time.

### System, apparatus, and method for configuring a packet switched network appliance to have access to a packet switched network

US 7,379,986 · Issued May 27, 2008

See patent

A network server is adapted to connect on the network with Internet appliances, and to fully configure such appliances over a network connection to access and operate on the Internet. In a preferred embodiment the appliances have first control routines adapted to cooperate with second routines at the server, and also a network address for connection. An initiation signal by a user at a network-connected appliance launches the first routines, causing the appliance to invoke the network address and to establish network communication with the server and to initiate configuration interaction. In some cases special telephone numbers are provided with new appliances, and the dial-up server, through Destination Number Information Service (DNIS) uses the dial-up number in conjunction with a data repository to select appropriate software for interfacing with and configuring a connecting appliance. A full range of services may be provided, including value-added services, such a browsers and browser configuration.

### Method and apparatus for providing an interactive home agent with access to call center functionality and resources

US 7,372,956 · Issued May 13, 2008

See patent

A call center system supports remote agent stations through a network by establishing a data link between a computer platform at the remote agent station and a CTI-processor connected to a telephony switch at the call center, and switching incoming calls from the call center to a telephone at the remote agent station while sending data pertaining to the calls via the data link to the computer platform at the remote agent station to be displayed. Data pertaining to calls is

scripts for an agent at the remote station. Call center services are supported by cooperation between software at the CTI processor and the computer platform at the remote station. In one embodiment the data link, once established, is kept open while calls continue to be switched to the remote station. In another, after an initial log in, dial up is done from the remote station upon detecting calls from the call center by a TAPI compliant device, and a reduced log in is performed at the CTI processor to save time. In a third alternative, the CTI processor, via a modem bank adapted for dialing, establishes the data connection each time a call is switched from the call center to the remote station. A plurality of remote stations may be thus supported.

**Other inventors**

## Simulcast web page delivery

US 7,349,975 · Issued Mar 25, 2008

See patent

A multimedia broadcast system provides program schedule information simulcast as a Hyper Text Markup Language (HTML) data stream including commands and displayable, selectable indicia associated with the commands, along with programs for display. A set top box is adapted to separate the HTML data stream and to store that data in a cache as WEB pages retrievable by a WEB browser in the set top box, whereupon the program schedule information is displayed including the displayable, selectable indicia. Selecting the indicia directs the set top box via the associated command to tune to a program associated with the displayable indicia. The indicia may be any text, icon, dynamic figurine, and the like. In a preferred embodiment program schedule WEB pages, including the commands and displayable indicia, are stored especially marked on a WEB server coupled to the Internet and to a scanner adapted to scan the WEB server for marked pages, and to upload the marked pages to a satellite broadcast system.

## Three dimensional light electronic programming guide

US 7,322,009 · Issued Jan 22, 2008

See patent

A method and apparatus of displaying an Electronic Programming Guide (EPG). In one embodiment, an EPG is displayed in a three dimensional virtual mesh, in which independent objects representing television programs are situated. The simplified nature of the three dimensional EPG reduces the amount of processing necessary to display it. In addition, the virtual mesh may be displayed isometrically, so that hardware requirements are further reduced and it may be possible to use a software only three dimensional graphics pipeline. If a user has a set top box (STB) with a hardware accelerated graphics pipeline, the EPG may

to types of television programs that they prefer, and these programs will be displayed more prominently.

### System and method for consolidated shipping and receiving using reusable containers

US 7,277,866 · Issued Oct 2, 2007

See patent

Products are delivered to customers using reusable containers. The reusable containers are equipped with a radio frequency identification (RFID) tag that is used by the vendor or deliverer to track whether the reusable container has been returned to the vendor or deliverer. The user can be credited with a deposit if he or she returns the container. The RFID can also be used to track the contents of a truck load or pallet load of containers.

Other inventors

### Method and apparatus for finding the same of similar shows

US 7,213,256 · Issued May 1, 2007

See patent

A method and apparatus providing for expanded search functionality in an electronic program guide (EPG) for television is described. The expanded search function finds show titles that are the same or similar to the show title of the program data currently displayed by the EPG. The expanded search function also finds shows similar to the one currently displayed by the EPG by using additional search elements based on the descriptive part of the EPG program data, such as actors, director, genre, etc., as well as search parameters based on the show time, channel, etc. Rather than only finding exact matches, the expanded search function uses fuzzy logic to find near matches and prioritizes the results according to the search elements and parameters as specified by the viewer.

### Embedded WEB phone module

US 7,190,692 · Issued Mar 13, 2007

See patent

A system for enabling Data Network Telephony (DNT) communication through a WEB page includes a Web server hosting an interactive WEB page and having an Internet port, a link in the WEB page adapted for launching a DNT-capable telephone module, and a DNT-capable telephone module associated with the link. In this system, upon selection of the link by a person accessing the WEB page

address pre-stored and associated with the link. The DNT network may be the Internet. In a preferred embodiment the system first investigates the computer platform for hardware and software characteristics, and attaches the determined characteristics to the instance of the IP telephone module to be downloaded. The downloaded module then self-launches and configures, and then launches the associated call. In some embodiments the module disappears after a single call, and thus serves as an instant enabler for IP telephony.

**Other inventors**

### Enhanced weather and traffic information from mobile communication devices

US 7,155,198 · Issued Dec 26, 2006

See patent

A network based information system has a server or other source management system connected to the network and to an information database, and a portable communication device enabled to access the server on the network by keypad entry, and to indicate geographic position upon access. The system is characterized in that the keypad is graphically mapped for direction, and the server, in response to a call placed from the portable communication device, including keypad input indicating direction, accesses the database for information associated with the geographic position and the direction, and transmits that information to the portable communication device. Other criteria, such as distance and information type may also be mapped and used in retrieving information. In the case of voice-capable devices, information is rendered as speech to be transmitted to the communication device.

### Integrating SIP control messaging into existing communication center routing infrastructure

US 7,120,141 · Issued Oct 10, 2006

See patent

A software suite is disclosed for routing communication events over a data-packet-network using an IP session initiation and management protocol. The software suite comprises, a server application running on the network for computing and serving routing determinations per request, a session management application running on the network for initiating and managing routed and established session events, a parsing application running on the network for parsing request data received under session initiation protocol and a conversion application running on the network for converting data received under session initiation protocol into a routing request. All received communication

application and routed to determined destinations and wherein events are
established as session events conducted under the session initiation and
management protocol.

### Method and system for localized advertising using localized 3-D templates

US 7,113,187 · Issued Sep 26, 2006

See patent

A method and system for localized advertising using localized 3-D templates is
disclosed. In one embodiment, a method for providing enhanced advertising of a
2-D video broadcast, comprises receiving the 2-D video broadcast, wherein the
2-D video broadcast comprises a 2-D advertisement containing a 2-D image, and
one or more 3-D shapes of text; generating a 3-D highlighted image from the 2-D
image; applying the 3-D shapes of text to the 3-D highlighted image to generate
a localized 3-D highlighted image; and displaying the localized 3-D highlighted
image to a specific viewer.

### Cursor control system

US 7,057,670 · Issued Jun 6, 2006

See patent

A method and apparatus for a novel cursor control system is disclosed. In one
embodiment, the invention is a method of manipulating a cursor on a tv screen
utilizing a wireless remote control. The method includes detecting a location on
the screen pointed to by the remote control. The method also includes
Transmitting the location to a set-top box.

### E-mail client with programmable address attributes

US 7,035,905 · Issued Apr 25, 2006

See patent

An e-mail processing application executable on a computer station having a video
display unit (VDU) searches a received e-mail for one or more words, phrases,
and addresses for comparison with stored words, phrases and addresses in a
stored table, and upon finding a match in the stored table, inserts one or more of
words, phrases, or addresses associated in the stored table with the words,
phrases or addresses from the received e-mail in any reply to the received e-mail.
In a preferred embodiment a "send to" address in a received e-mail triggers
automatically one or both of a particular "from" and "reply to" address in any
response to the received e-mail. In an alternative embodiment, a "send to"
address in a received e-mail, as a result of a table look-up, automatically prepares
and sends a new e-mail identical to the received e-mail except for a new "send
to" address retrieved from the stored table. In alternative embodiments the

## Integrated network switching hub and bus structure

US 7,020,735 · Issued Mar 28, 2006

See patent

A network switching hub is implemented on an IC chip, and has a bus connected to external ports through sets of queue switch transistors, source to drain for data switched onto the bus, the queue switch transistors gated simultaneously by control lines from an on-board arbitrator controller following a preprogrammed arbitration scheme. Data is switched off the bus and hub by port adapter controllers connected to read amplifier receivers connected directly to the on-chip bus, the port adapter controllers enabled by the arbitrator controller following the same preprogrammed arbitration scheme. Ports may be serial or parallel, and may be adapted to special purposes, such as PCI and hub to hub connection for expansion.

## Management of data before zero volt suspend in computer power management

US 7,013,397 · Issued Mar 14, 2006

See patent

A power management system for computers compresses contents of system RAM and stores the contents on a non-volatile storage device before power is suspended to a motherboard, which removes power also from RAM. By compression, the capacity required of the non-volatile storage device is minimized. In a variation, zeros are stored in all RAM area used by memory management software before compression and storage on the non-volatile device. In another variation, areas of RAM used by memory management software are identified, and only those areas not used by memory management software are stored on the non-volatile device. The capability is provided in several ways in different embodiments.

**Other inventors**

## System and method for amalgamating multiple shipping companies using reusable containers and wide area networks

US 6,988,079 · Issued Jan 17, 2006

See patent

A system and method for delivering packages using a vehicle such as a truck. The packages contain RFIDs that can be electronically queried when the truck is at a

the driver can identify those packages. The truck can have an RFID affixed thereto, so that when the driver arrives at the destination, a computer system is informed and can communicate said instructions to the driver. The instructions can be generated using a data base at a remote location coupled to a system within the truck (or within the destination).

**Other inventors**

### Using XML expressed primitives for platform and system-independent call modeling

US 6,985,478 · Issued Jan 10, 2006

See patent

A system for providing third-party call control in a telecommunications environment is provided. The system comprises, a call-control mechanism for providing service logic and routing intelligence, a control application for providing service-logic description and command instruction for implementing third-party controlled call connections, a call-switching mechanism for providing an abstract state of switching matrix and for commutation of external and internal call legs and a commutation application for making and breaking call connections according to commands sent from the control application. The call-control mechanism, using the control application, sends primitive text commands to the call-switching mechanism, which utilizing the commutation application, receives, reads and implements the text commands containing all of the service logic and instructions required to successfully construct call connections and wherein the call-switching mechanism by virtue of the commutation application sends notification of success or failure regarding implementation of received commands back to the control application.

**Other inventors**

### Electronic document answering machine

US 6,973,167 · Issued Dec 6, 2005

See patent

An Electronic Document Answering Machine is adapted to connect to remote information sources and to download digital documents including e-mail and WEB pages, and to store the documents for later review by a user. The Answering machine has an alert device for alerting a user that new documents are available

are communicated over a speaker via voice synthesis. In an alternative preferred embodiment a small display is provided wherein documents may be displayed in alphanumeric characters. The answering machine can be implemented as a stand-alone device or can be connected via a serial port to a host PC for transferring documents to the PC for processing and review. In other embodiments the Answering Machine is implemented as a system in a PC, with alert and selective input added as an interface. The interface can be in a keyboard, and can be provided by existing keys and LEDs on a keyboard. An Answering Machine is also provided as a set-top-box for a TV, downloading digital documents from the Internet and providing the documents with user prompting to a TV via an audio/video output. prompting may be by infrared input from a remote controller.

### Method and system for implementing an electronic program guide using partitioned memory and partial titles

US 6,944,741 · Issued Sep 13, 2005

See patent

In one embodiment, there is provided a method for storing program information in a memory associated with an electronic program guide system. The method comprises partitioning the memory into two areas, wherein a first of said areas is structured to hold records of a first type, each comprising a first subset of information about a program including a partial title therefor, and wherein a second of said areas is structured to hold records of a second type, each comprising a second subset of information about the program; and linking records of the first and second type through a common field.

**Other inventors**

### Wirefree mobile device power supply method & system with free positioning

US 6,913,477 · Issued Jul 5, 2005

See patent

The invention provides an electrical coupling device. The coupling includes a contactor device and a plurality of electrical contacts which close an electrical circuit between the contactor device and an adaptor device when the adaptor device is brought into physical contact with the contactor device, there being no need for aligning for the electrical contacts of the contactor device with electrical contact of the adaptor device.

### Three dimensional light electronic programming guide

US 6,836,274 · Issued Dec 28, 2004

See patent

A method and apparatus of displaying an Electronic Programming Guide (EPG). In one embodiment, an EPG is displayed in a three dimensional virtual mesh, in which independent objects representing television programs are situated. The simplified nature of the three dimensional EPG reduces the amount of processing necessary to display it. In addition, the virtual mesh may be displayed isometrically, so that hardware requirements are further reduced and it may be possible to use a software only three dimensional graphics pipeline. If a user has a set top box (STB) with a hardware accelerated graphics pipeline, the EPG may be displayed in a full three dimensional perspective view. A user can navigate the mesh to find television programs that they wish to view. A user can assign values to types of television programs that they prefer, and these programs will be displayed more prominently.

### Methods and apparatus for enhancing wireless data network telephony, including quality of service monitoring and control

US 6,795,406 · Issued Sep 21, 2004

See patent

A system for wireless communication comprises an architecture of routers connected to a network and having connected transceivers for wireless transmission and reception of data, and a plurality of hand-held communicators adapted for users to communicate with the network through the routers. The system is adapted to provide wireless Data Network Telephony (DNT), and the hand-held communicators execute Quality of Service (QoS) code adapted to prioritize DNT packet code over all non-DNT traffic, thereby preserving the real-time nature of the DNT code.

### E-mail client with programmable address attributes

US 6,785,710 · Issued Aug 31, 2004

See patent

An e-mail processing application executable on a computer station having a video display unit (VDU) searches a received e-mail for one or more words, phrases, and addresses for comparison with stored words, phrases and addresses in a

phrases or addresses from the received e-mail in any reply to the received e-mail. In a preferred embodiment a "send to" address in a received e-mail triggers automatically one or both of a particular "from" and "reply to" address in any response to the received e-mail. In an alternative embodiment, a "send to" address in a received e-mail, as a result of a table look-up, automatically prepares and sends a new e-mail identical to the received e-mail except for a new "send to" address retrieved from the stored table. In alternative embodiments the application simply provides variable fields in a reply window for a user to enter variable "from" and "reply to" addresses.

## Real world/virtual world correlation system using 3D graphics pipeline

US 6,778,171 · Issued Aug 17, 2004

See patent

A method of tracking objects that allows objects to be tracked across multiple scene changes, with different camera positions, without losing track of the selected object. In one embodiment, a method of tracking an object using a computer, a display device, a camera, and a camera tracking device, the computer being coupled to the display device, the camera and the camera tracking device is disclosed. The method includes: A first image from within a field-of-view of the camera is captured. The first image, which includes an actual object with a tracking device, is displayed on the display device. Information about the tracking device's location is received. The information is used to create a virtual world reflecting the actual object's position within the field-of-view of the camera as a shape in the virtual world. Information about the camera tracking device is received. A virtual-camera position in the virtual world is created. A 3D graphics pipeline is used to create a second image, the second image presenting the shape in the virtual world. The second image is used to obtain the actual object's position. In another embodiment, the method includes using the virtual-camera's position to compute a new position for the camera to track the actual object.

## Multiple methods and systems for connecting or tapping into fiber optics

US 6,744,946 · Issued Jun 1, 2004

See patent

An apparatus for interfacing optical signals to an optical fiber has a layered interface element with a first electrically conductive layer defining a first surface, a photoactive material layer in intimate contact with the first layer on a second surface opposite the first surface, a second electrically conductive layer in intimate contact with the photoactive material layer, confining the photoactive material layer between the first and second electrically conductive layers, and a

translatable toward the first surface of the interface element, to urge an optical fiber positioned across the interface element into the first surface, and by local deformation of the optical fiber also into the third surface, creating thereby an intimate contact region between an edge of the photoactive layer intersecting the third surface and the optical fiber. Indentions may be provided in a fiber to facilitate engagement of elements.

### Integrated network switching hub and bus structure

US 6,678,778 · Issued Jan 13, 2004

See patent

A network switching hub is implemented on an IC chip, and has a bus connected to external ports through sets of queue switch transistors, source to drain for data switched onto the bus, the queue switch transistors gated simultaneously by control lines from an on-board arbitrator controller following a preprogrammed arbitration scheme. Data is switched off the bus and hub by port adapter controllers connected to read amplifier receivers connected directly to the on-chip bus, the port adapter controllers enabled by the arbitrator controller following the same preprogrammed arbitration scheme. Ports may be serial or parallel, and may be adapted to special purposes, such as PCI and hub to hub connection for expansion.

### Method and apparatus for enhancing wireless data network telephony, including quality of service monitoring and control

US 6,625,126 · Issued Sep 23, 2003

See patent

A system for wireless communication comprises an architecture of routers connected to a network and having connected transceivers for wireless transmission and reception of data, and a plurality of hand-held communicators adapted for users to communicate with the network through the routers. The system is adapted to provide wireless Data Network Telephony (DNT), and the hand-held communicators execute Quality of Service (QoS) code adapted to prioritize DNT packet code over all non-DNT traffic, thereby preserving the real-time nature of the DNT code.

### Method and apparatus for configuration of an internet appliance

US 6,622,169 · Issued Sep 16, 2003

See patent

A network server is adapted to connect on the network with Internet appliances, and to fully configure such appliances over a network connection to access and operate on the Internet. In a preferred embodiment the appliances have first

connected appliance launches the first routines, causing the appliance to invoke the network address and to establish network communication with the server and to initiate configuration interaction. In some cases special telephone numbers are provided with new appliances, and the dial-up server, through Destination Number Information Service (DNIS) uses the dial-up number in conjunction with a data repository to select appropriate software for interfacing with and configuring a connecting appliance. A full range of services may be provided, including value-added services, such a browsers and browser configuration.

### Management of data before zero volt suspend in computer power management

US 6,618,812 · Issued Sep 9, 2003

See patent

A power management system for computers compresses contents of system RAM and stores the contents on a non-volatile storage device before power is suspended to a motherboard, which removes power also from RAM. By compression, the capacity required of the non-volatile storage device is minimized. In a variation, zeros are stored in all RAM area used by memory management software before compression and storage on the non-volatile device. In another variation, areas of RAM used by memory management software are identified, and only those areas not used by memory management software are stored on the non-volatile device. The capability is provided in several ways in different embodiments.

**Other inventors**



### System for controlling processing of data passing through network gateway between two disparate communications network

US 6,603,762 · Issued Aug 5, 2003

See patent

A control system is provided for controlling the aspects of data conversion and routing of data passing between two disparate communications networks. The system operates from a network-connected computer node running a software application. The computer node acquires the data protocol associated with the data en-route from one network to another and using the software application, formulates the required conversion commands and routing instructions based on information provided by the protocol signal. The generated commands are routed to the appropriate conversion nodes through which the data will pass into the next network. The conversion nodes apply the commands routed to them by the computer node to the appropriate data passing through the nodes. In one application, the control system combines the total hardware and software

## Removable computer display interface

US 6,590,547 · Issued Jul 8, 2003

See patent

A portable computer is configured to accept removable modular display panels of different types that plug into a structure hinged to the body of the computer. Each display panel has a sliding engagement means fixed along a lower edge, and the hinged structure has a mating sliding engagement means along an upper edge and parallel to the axis of the hinge, allowing a display panel to engage and disengage in the direction of the axis of the hinge. In an embodiment of the invention, display modules adaptable to the computer have a code stored in a memory device that is accessible on start-up by the computer, to identify and load a display driver routine capable of driving the display module assembled to the computer.

## Method and apparatus for creating a white-light interference hologram from PC input photographic data

US 6,587,234 · Issued Jul 1, 2003

See patent

A system for producing a white-light interference hologram includes a camera adapted for recording a first and a second bitmap image of a scene from separate vantage points, and the separation distance of the vantage points, a computing engine adapted to compute three-dimensional x, y, and z characteristics of an interference hologram topology for the scene from the bitmap image and separation data, wherein x and y are two dimensional locations of bits in a bitmap of the topology and z is a depth dimension for each x,y bit, and a printer adapted to print in color the x,y bitmap, and to create the depth dimension z at each x,y bit location, providing thereby a three-dimensional interference hologram topology for the scene. In a preferred embodiment the depth dimension is created by electrophoresis, using a medium having an electrophoretic gel layer, with the ink applied to the gel in a bit-mapped pattern being ionic in nature, and capable of being migrated in the gel layer by electrophoresis. In other embodiments the third dimension is provided by using magnetic ink and migrating the bits using controlled magnetic fields.

## Method and apparatus for execution of an application during computer pre-boot operation and post-boot under normal OS control

US 6,564,318 · Issued May 13, 2003

See patent

application and at least one presentation playable by the application. The BIOS calls the PAM on startup, and the PAM checks for an application, and finding same loads and executes the application before loading the operating system (OS). In a preferred embodiment the FSS is programmable, and the system after OS boot is started checks MSD devices for new FSS parameters, and finding same loads the parameters to the programmable FSS of the BIOS. In some embodiments parameters may cause presentations and associated applications to be accessed and executed in a rotating or serial order. In other embodiments the BIOS represents its own address space in RAM to the OS at OS boot to include the application, enabling the application to continue to execute during OS boot. In further embodiments a special driver is executed after OS boot to bind the application into the OS configuration so the application may continue to operate in a stable manner.

**Other inventors**

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### Method and apparatus for call distribution and override with priority recognition and fairness timing routines

US 6,563,788 · Issued May 13, 2003

See patent

A method for promoting fairness in a communication center in response to requests for destination numbers (DNs) from network-level routers has steps of determining latency for requests from individual ones of the network-level routers, receiving a request from a first router for which latency is determined, assigning a fairness wait time to the request, the time determined as an inverse function of latency, and answering the request according to rules in effect only after the wait time has expired. In some cases requests arrive with priority, and priority is used a swell as latency in determining wait time. In other cases a second fairness time is imposed, after which a fairness algorithm is called to award a DN according to statistical history and cal priority. The system is useful for communication centers for connection-oriented telephone systems, Internet protocol systems, and for all sorts of digital messaging and mail systems.

**Other inventors**

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### Noise reduction techniques and apparatus for enhancing wireless data network telephony

in  🔍                                        🏠            👥            💼
                                           Home      My Network      Jobs       Me

A system for wireless communication comprises an architecture of routers connected to a network and having connected transceivers for wireless transmission and reception of data, and a plurality of hand-held communicators adapted for users to communicate with the network through the routers. The system is configured for data network telephony (DNT) in the wireless portion, wherein voice data is encoded and transmitted in real time in data packets, and also provides data exchange for document-type entities. In one aspect a unique mirroring of channels from the wireless portion to a hard-wired link provides for mutual access and sharing of overall bandwidth from and to individual transceivers.

### Tailoring data and transmission protocol for efficient interactive data transactions over wide-area networks

US 6,553,410 · Issued Apr 22, 2003

See patent

A system is provided for improving data transmission to computers and computerized appliances connected directly or indirectly to the Internet or other wide area data network. In this system software at a proxy server uses prestored characteristics of client devices to translate data from Internet sources into a reduced-content form adapted specifically to the client device. Unique functionality for the system includes templates provided for specifying WEB page to client translation, and special scripts for prefetching pages in real-time. Systems are provided for many sorts of client devices and hosted devices.

### Simplified-file hyper text protocol

US 6,535,922 · Issued Mar 18, 2003

See patent

A system is provided wherein relatively low-end computers, such as portable, battery-powered computers ordinarily incapable of sophisticated Internet browsing functions may be used to browse the Internet. The enhanced computing ability for such portables is provided by a unique Internet server adapted for transposing data files to alternative, low-information-density form, preferably comprising simplified or single files suitable for rapid processing and display by connected portable and other low-end computers in embodiments wherein batter-powered field units are used, battery life is exhibited far beyond what would be expected for a battery-powered computer with computing power for browsing the Internet directly. In some embodiments of the invention adapted files are saved and identified for future use in communicating with specific devices over Internet connections.

See patent

A personal digital assistant module with a local CPU, memory, and I/O interface has a host interface comprising a bus connected to the local CPU and a connector at a surface of the personal digital assistant for interfacing to a bus connector of a host general-purpose computer, providing direct bus communication between the personal digital assistant and the host general-purpose computer. In an embodiment, the personal digital assistant also has a means for storing a security code. The personal digital assistant according to the invention forms a host/satellite combination with a host computer having a docking bay, wherein upon docking a docking protocol controls access by the host to memory of the personal digital assistant based on one or more passwords provided by a user to the host. In another embodiment the personal digital assistant has a compressed BIOS chip, and in yet another embodiment also has an expansion port connected to the local CPU, and expansion peripheral devices may be connected and operated through the expansion port.

**Other inventors**

## Multiple methods and systems for connecting or tapping into fiber optics

US 6,519,391 · Issued Feb 11, 2003

See patent

An apparatus for interfacing optical signals to an optical fiber has a layered interface element with a first electrically conductive layer defining a first surface, a photoactive material layer in intimate contact with the first layer on a second surface opposite the first surface, a second electrically conductive layer in intimate contact with the photoactive material layer, confining the photoactive material layer between the first and second electrically conductive layers, and a third surface angularly disposed to the first surface and intersecting the photoactive material layer; and a pressure element having a contact surface translatable toward the first surface of the interface element, to urge an optical fiber positioned across the interface element into the first surface, and by local deformation of the optical fiber also into the third surface, creating thereby an intimate contact region between an edge of the photoactive layer intersecting the third surface and the optical fiber. Indentions may be provided in a fiber to facilitate engagement of elements.

Show more results

US005539616A

# United States Patent [19]

## Kikinis

[11] **Patent Number:** **5,539,616**

[45] **Date of Patent:** *****Jul. 23, 1996**

[54] **MODULAR PORTABLE COMPUTER**

[75] Inventor: **Dan Kikinis**, Saratoga, Calif.

[73] Assignee: **Elonex Technologies, Inc.**, Sunnyvale, Calif.

[ * ] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,278,509.

[21] Appl. No.: **159,078**

[22] Filed: **Nov. 29, 1993**

### Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 97,946, Jul. 26, 1993, Pat. No. 5,278,730, which is a continuation of Ser. No. 905,480, Jun. 29, 1992, abandoned.

[51] **Int. Cl.$^6$** ................................. **G06F 1/16**; H05K 7/10
[52] **U.S. Cl.** .......................... **361/686**; 361/683; 361/726; 361/727
[58] **Field of Search** ........................ 364/708.1; 439/928; 345/169, 905; 312/223.2; 361/679–686, 724–727, 752, 796, 826, 827

[56] **References Cited**

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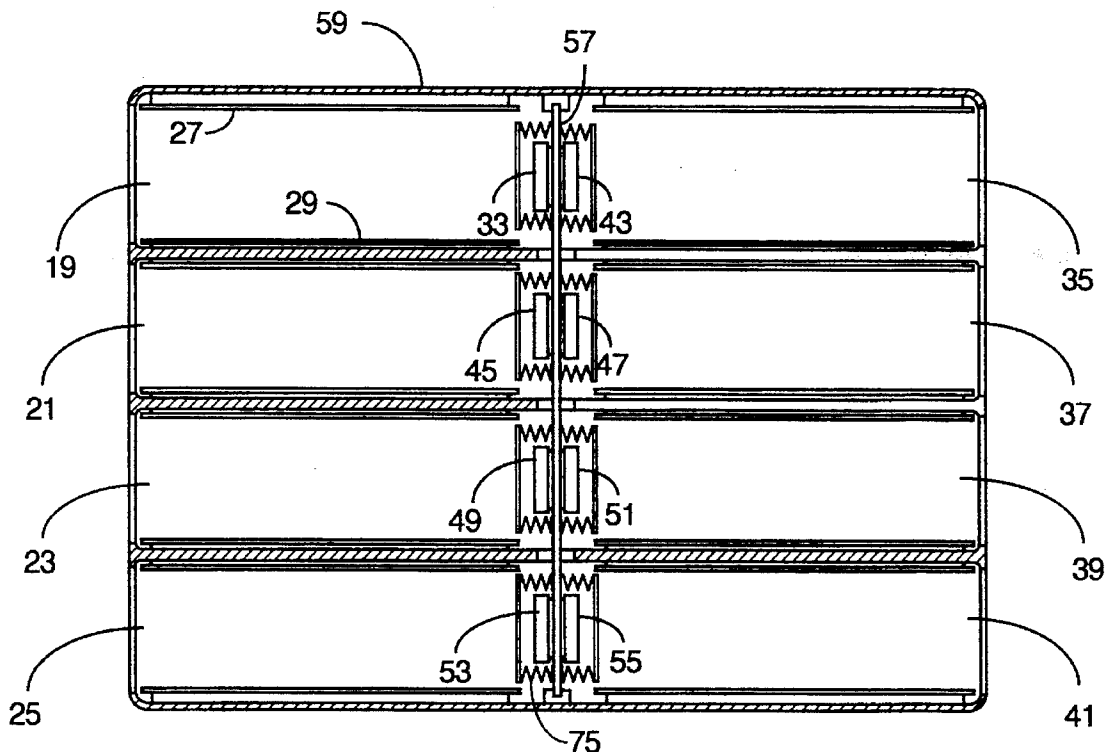| | | | |
|---|---|---|---|
| 4,545,023 | 10/1985 | Mizzi ................................. | 361/680 X |
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| 5,331,509 | 7/1994 | Kikinis ................................. | 361/686 |

*Primary Examiner*—Michael W. Phillips
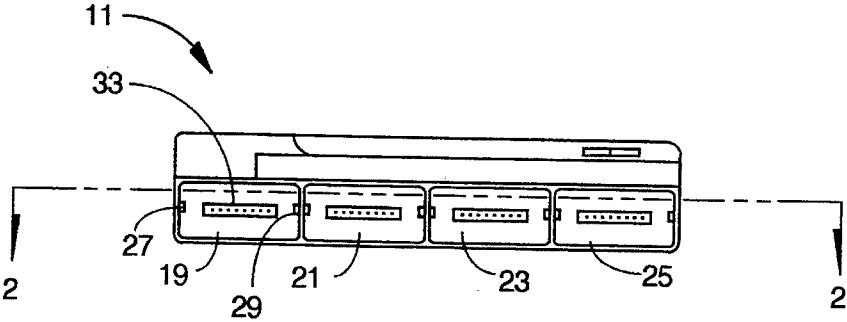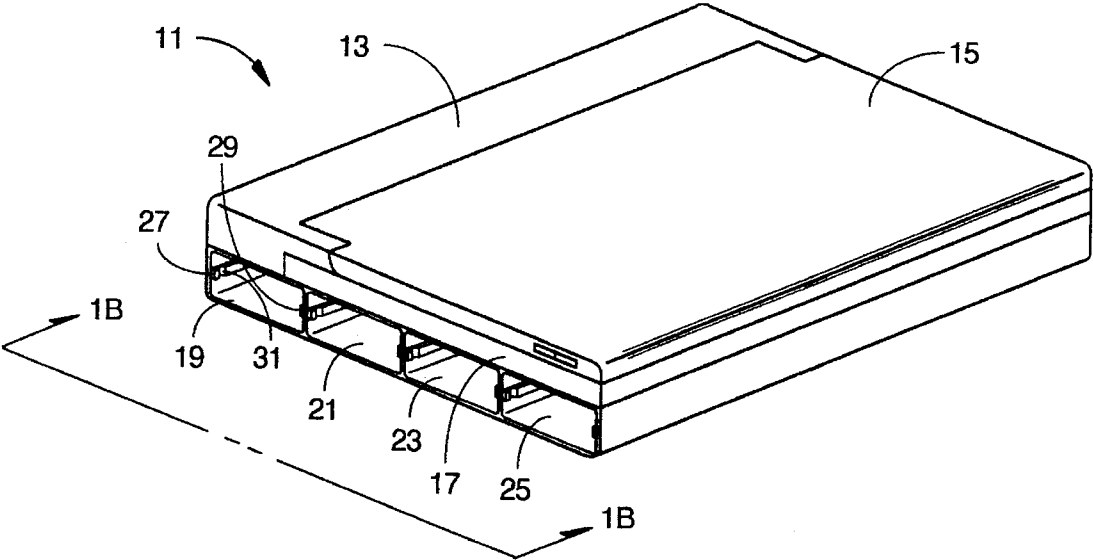*Attorney, Agent, or Firm*—Donald R. Boys

[57]                    **ABSTRACT**

A modular computer has a framework with module bays for receiving CPU modules, power modules, and peripheral function modules such as floppy and hard disk drives. The framework has a built-in compressed bus and a variety of function modules which can be plugged into any one of the module bays. Function modules include, but are not limited to, CPU, power, floppy disk, hard disk, RAM memory, LAN communication, modem, FAX communication, and data acquisition. In some embodiments function modules are provided for communicating with separate input means, such as voice, keyboards, and pen-pads. In one aspect the module bays and the function modules are configured according to dimensional and connective standards of the Personal Computer Memory Card International Association.
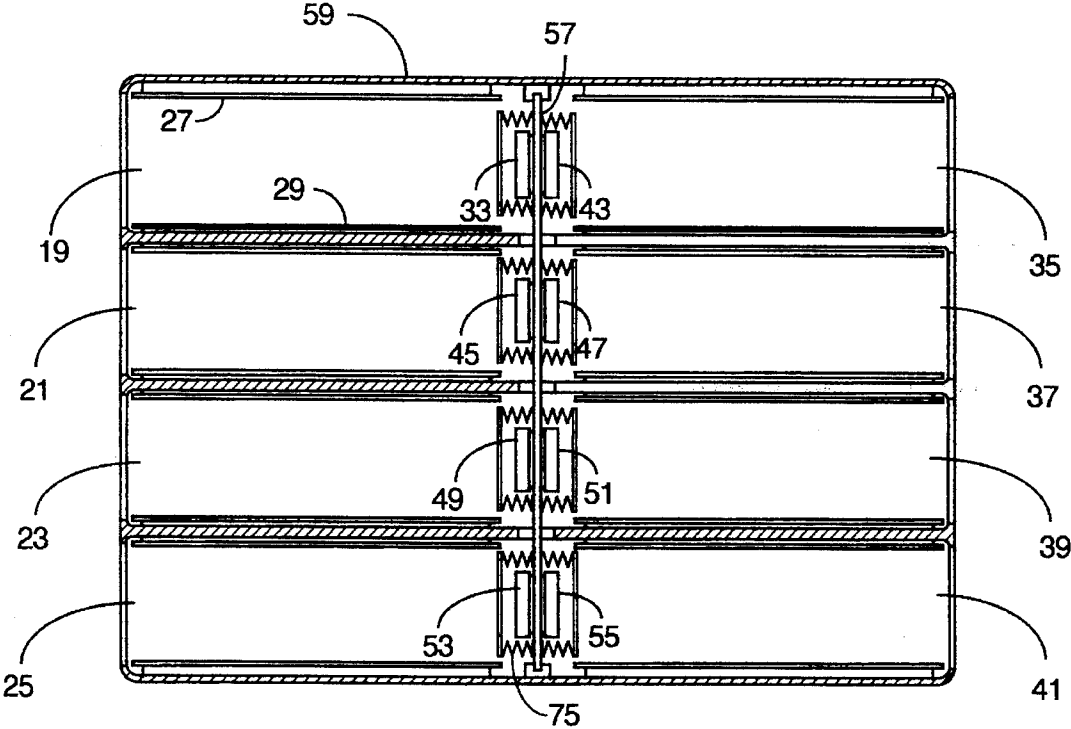
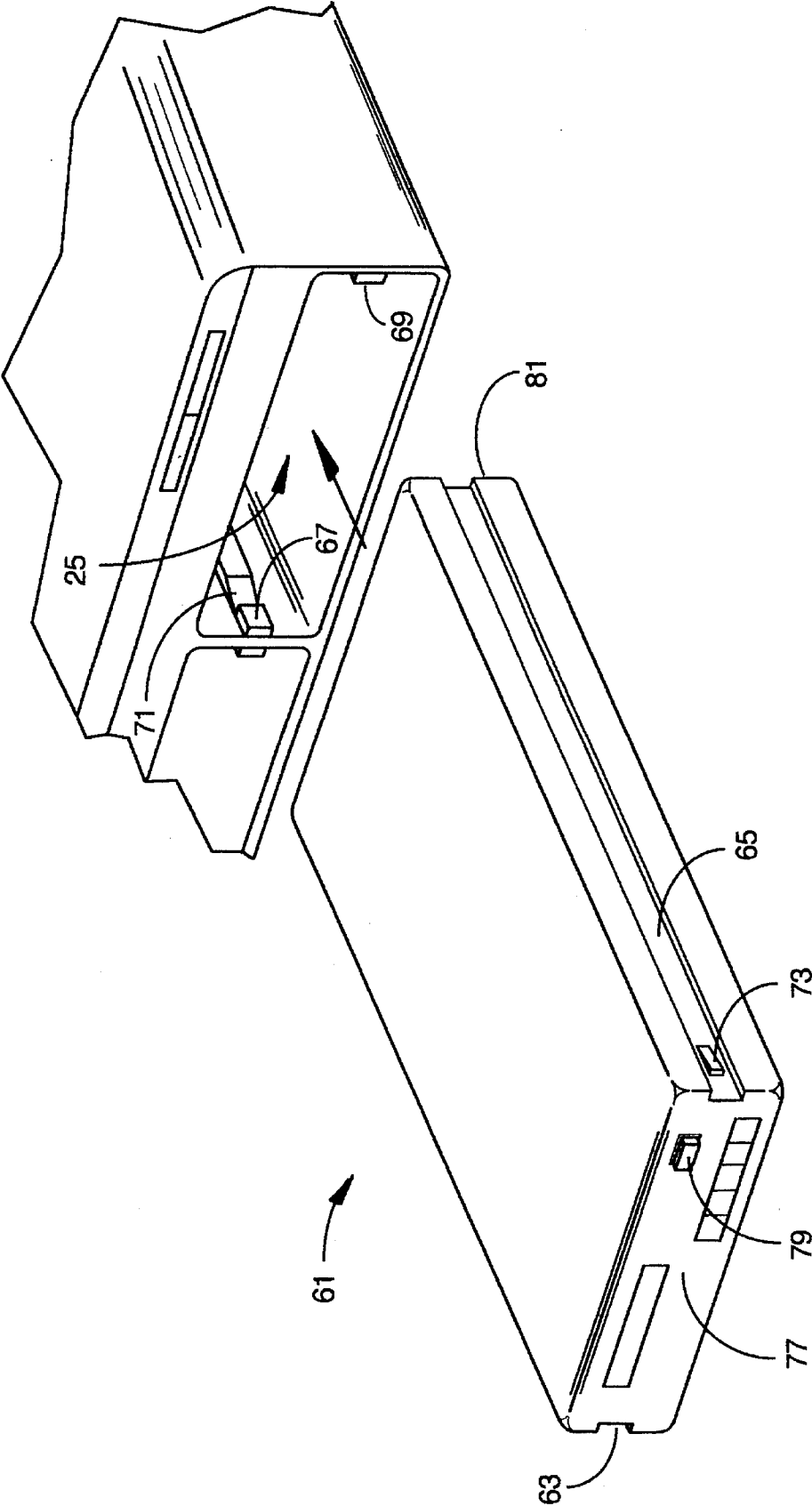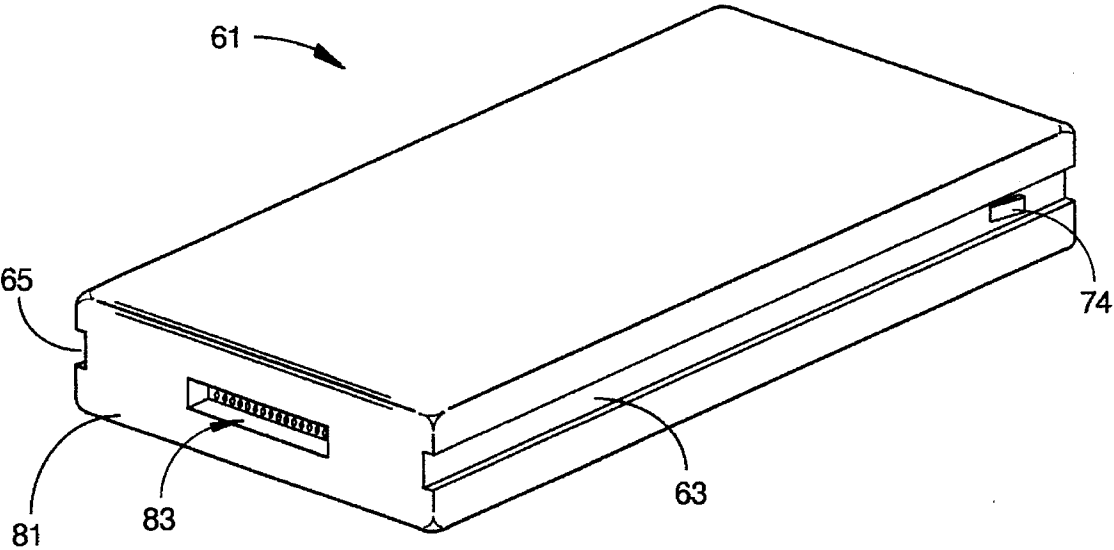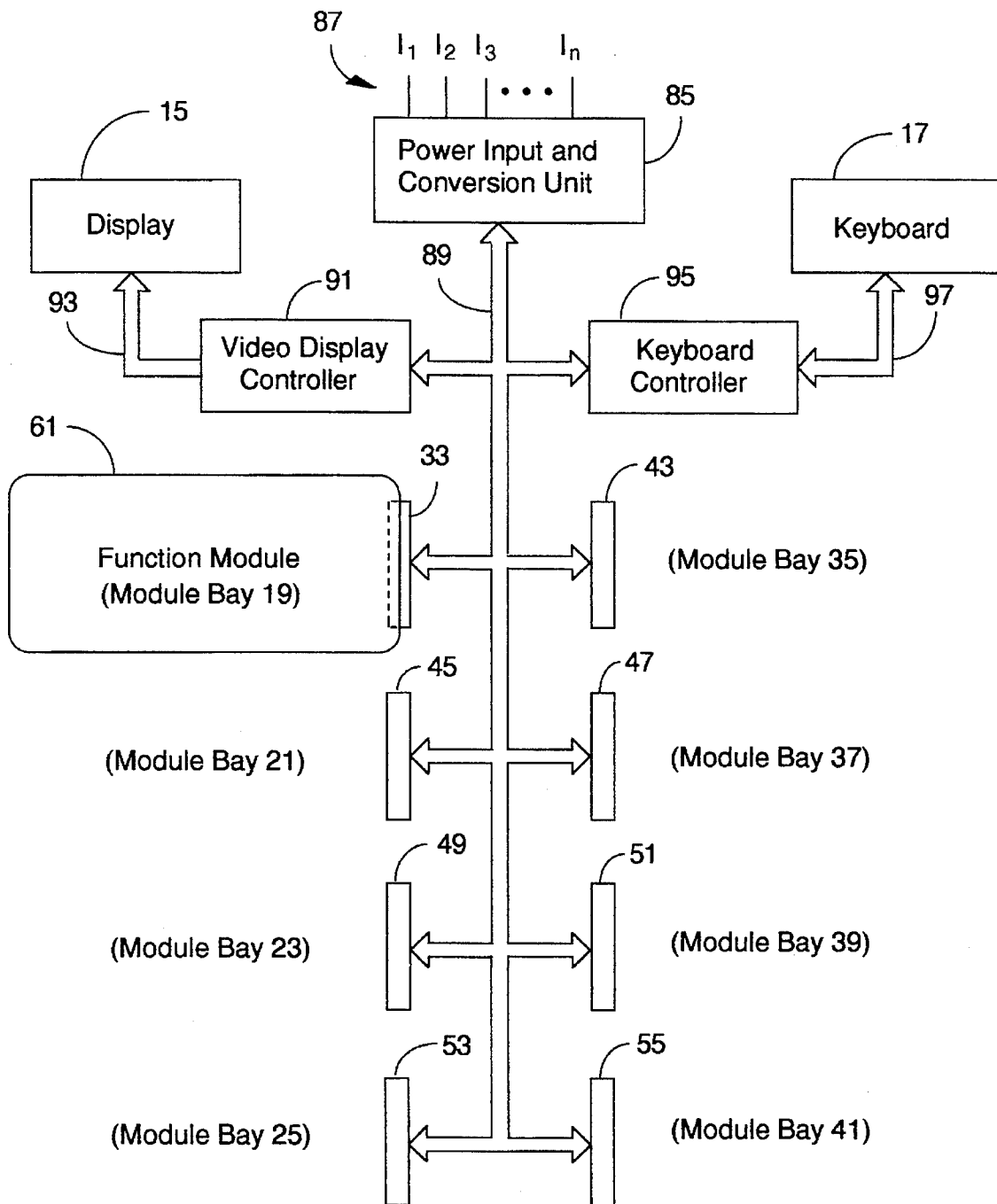**14 Claims, 18 Drawing Sheets**

Fig. 1A

Fig. 1B

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Fig. 2

Fig. 3

Fig. 4

87

$I_1$  $I_2$  $I_3$        $I_n$

85

Power Input and
Conversion Unit

15

Display

17

Keyboard

93

91

Video Display
Controller

89

95

Keyboard
Controller

97

61

33

Function Module
(Module Bay 19)

43

(Module Bay 35)

45

(Module Bay 21)

47

(Module Bay 37)

49

(Module Bay 23)

51

(Module Bay 39)

53

(Module Bay 25)

55

(Module Bay 41)

Fig. 5

Fig. 6

Fig. 7

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Fig. 8

Fig. 9

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Fig. 10

Fig. 11

Fig. 12

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Fig. 13

Fig. 14

221

223

225

15B
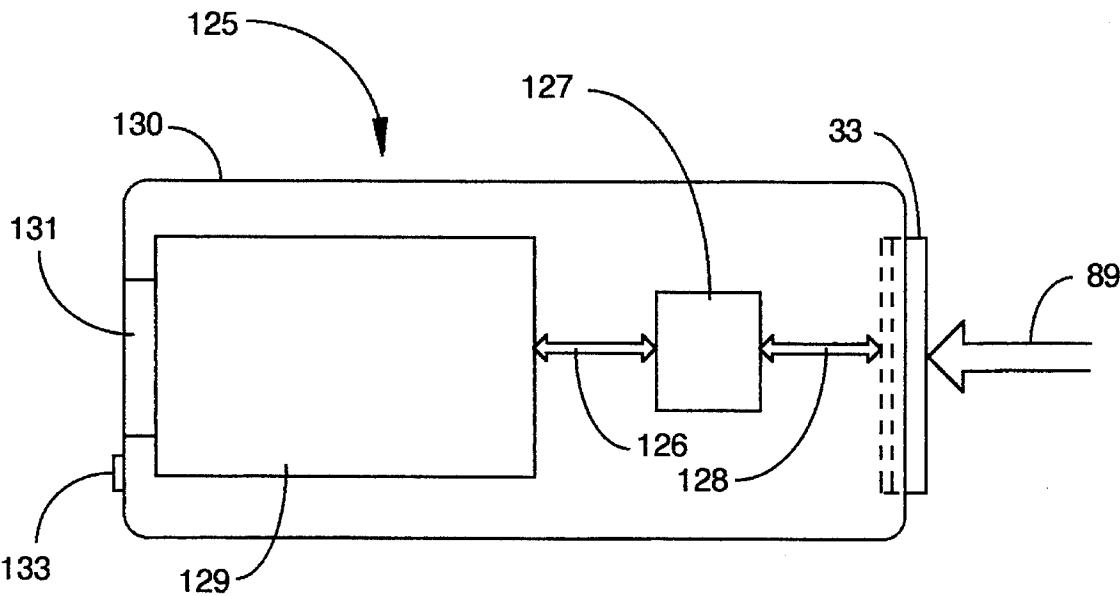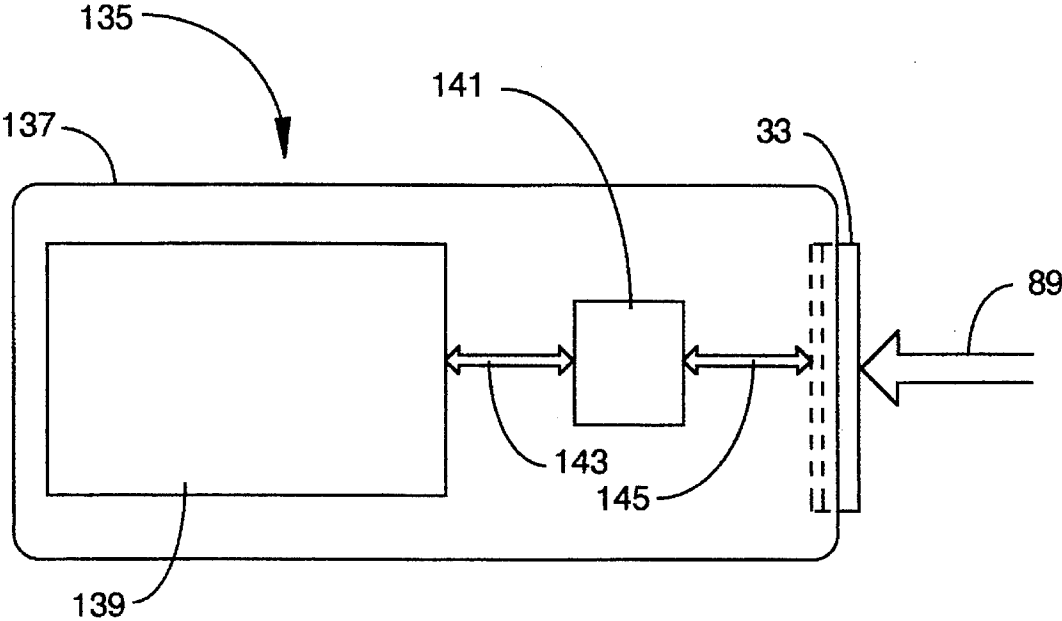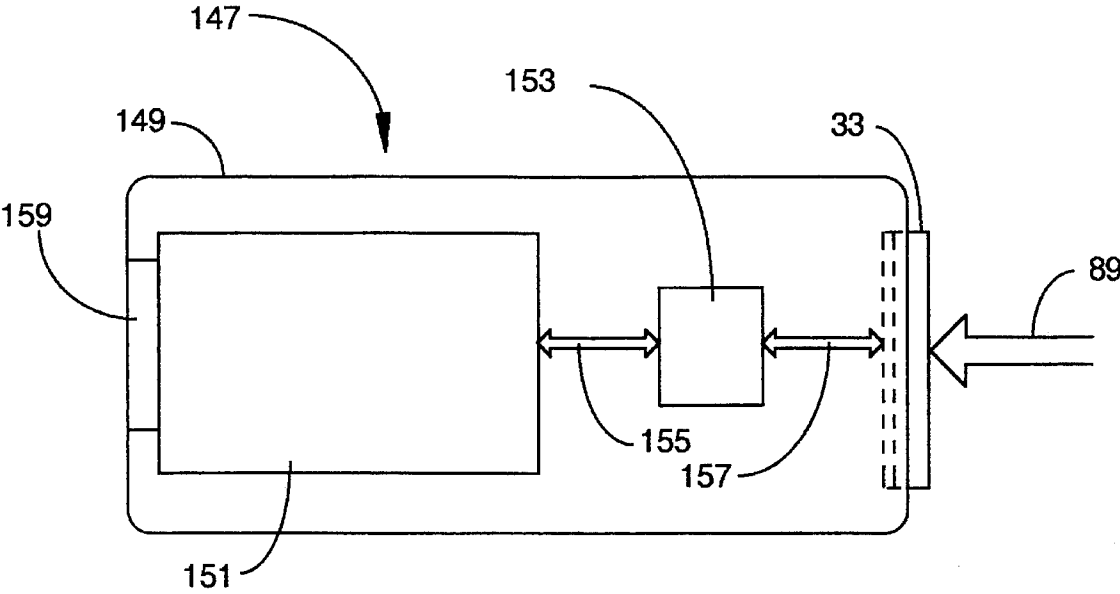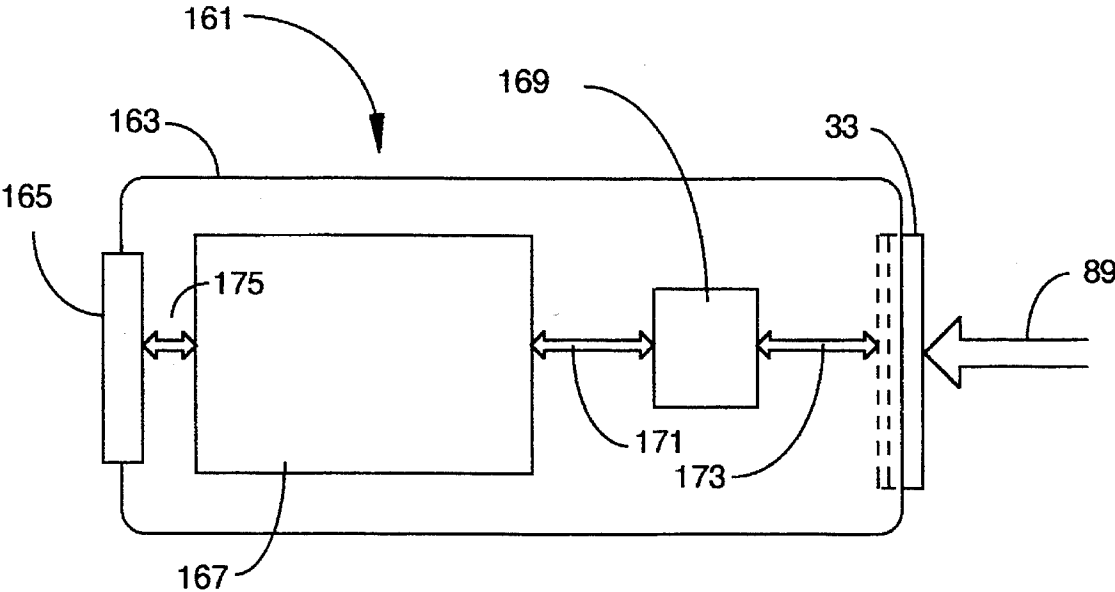
229

227

15B

Fig. 15A

221

229　　227　　225

16　　　230A　　230B　　16

231

Fig. 15B
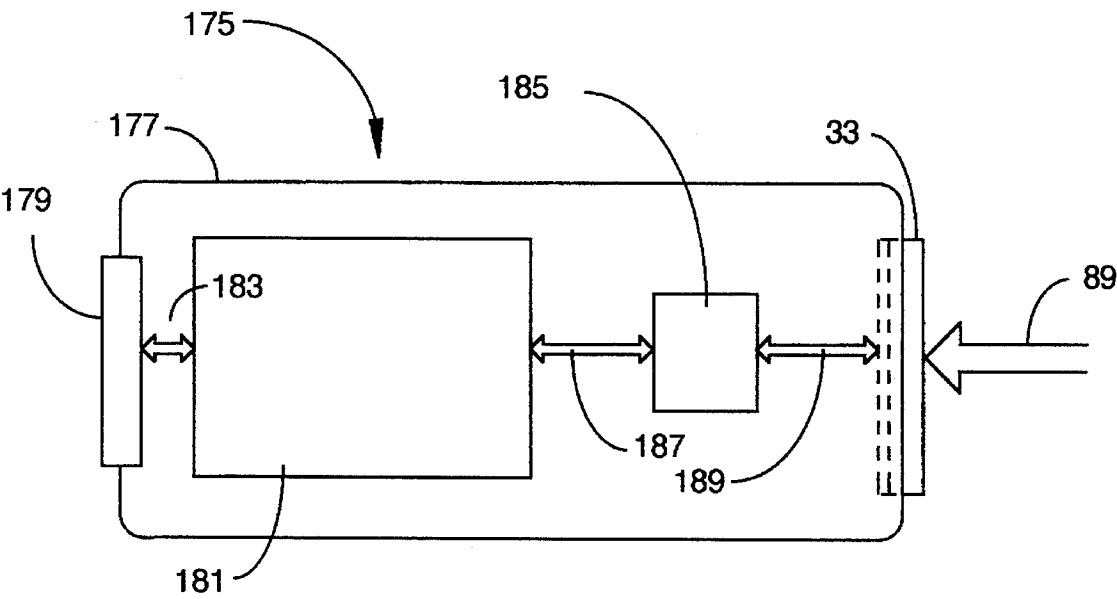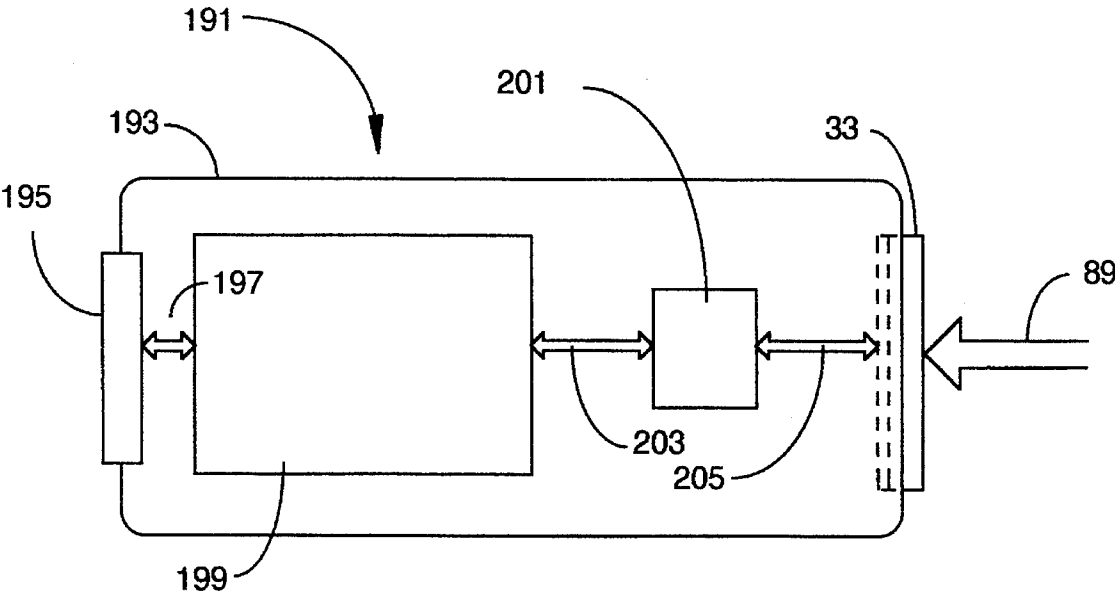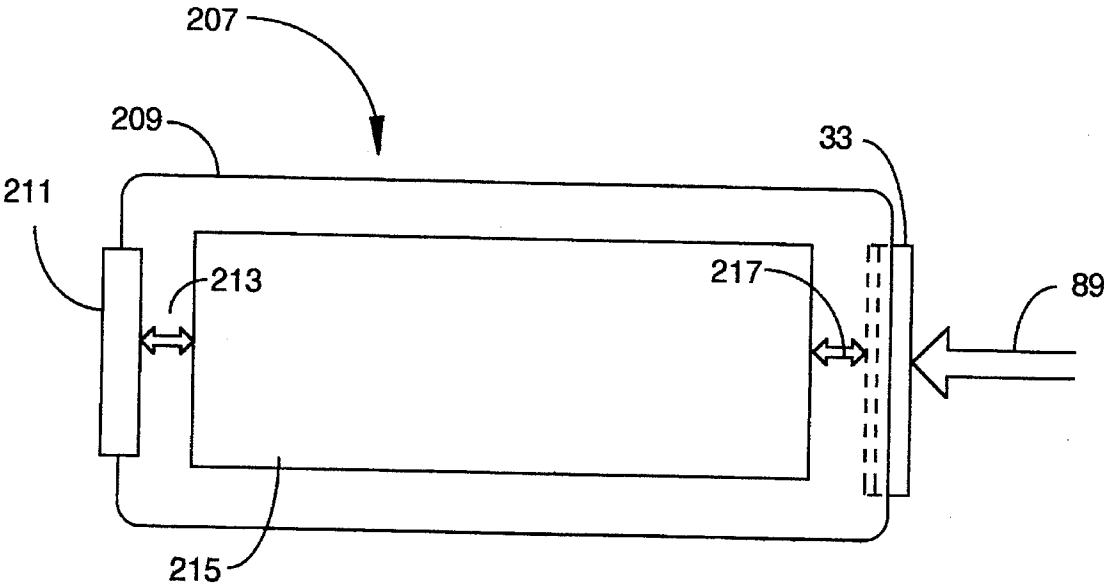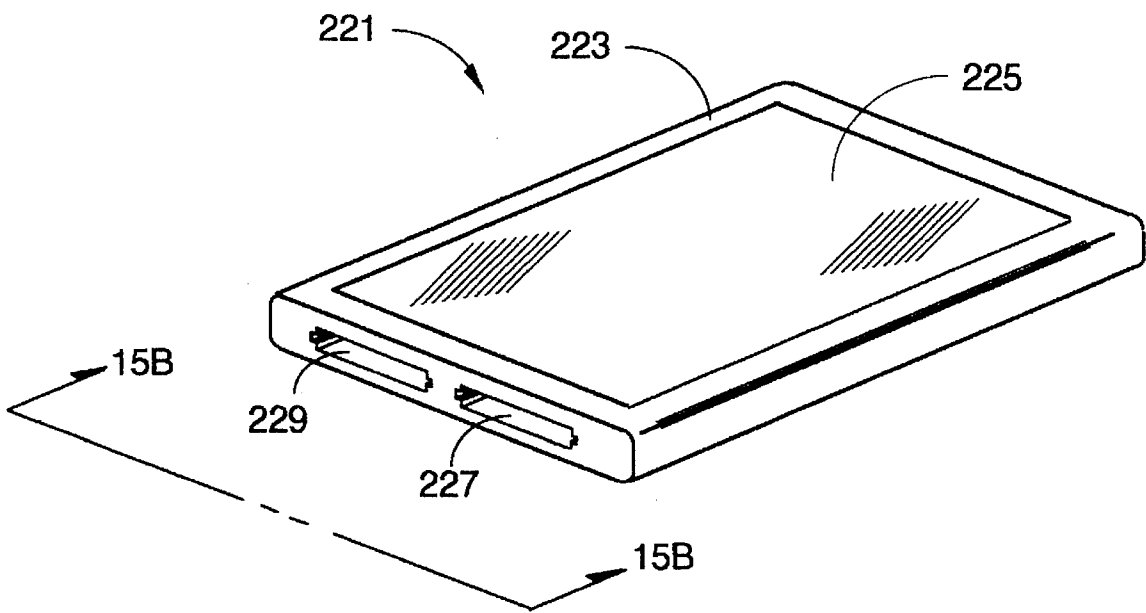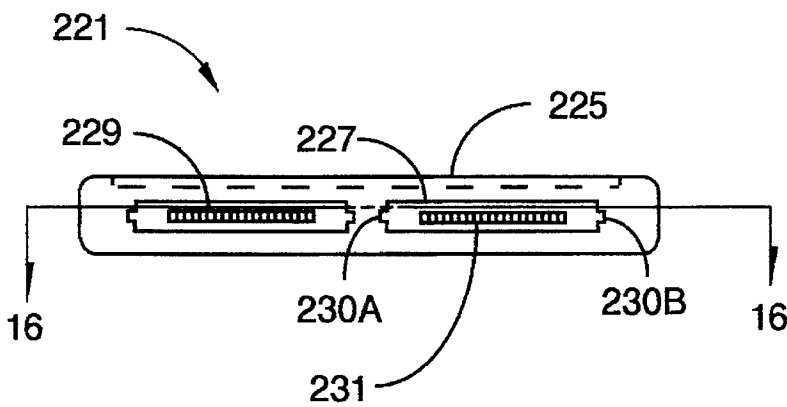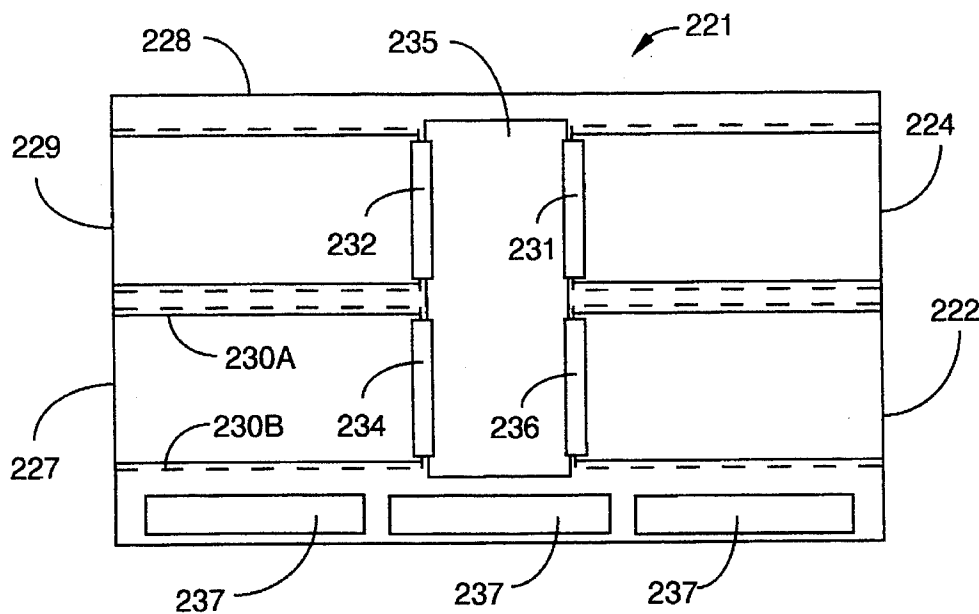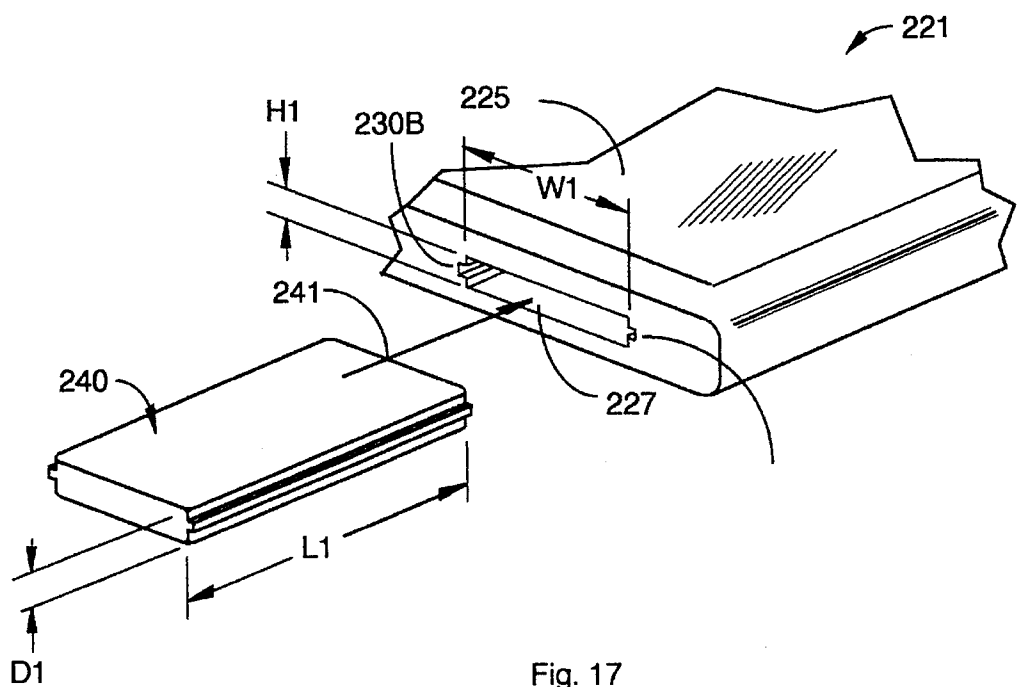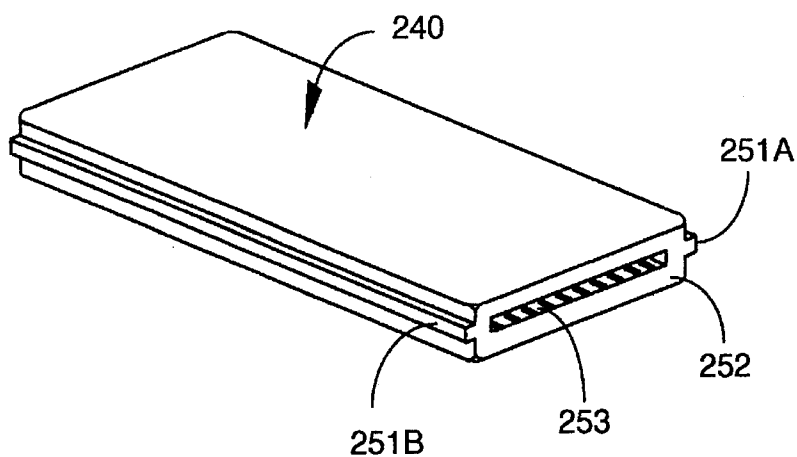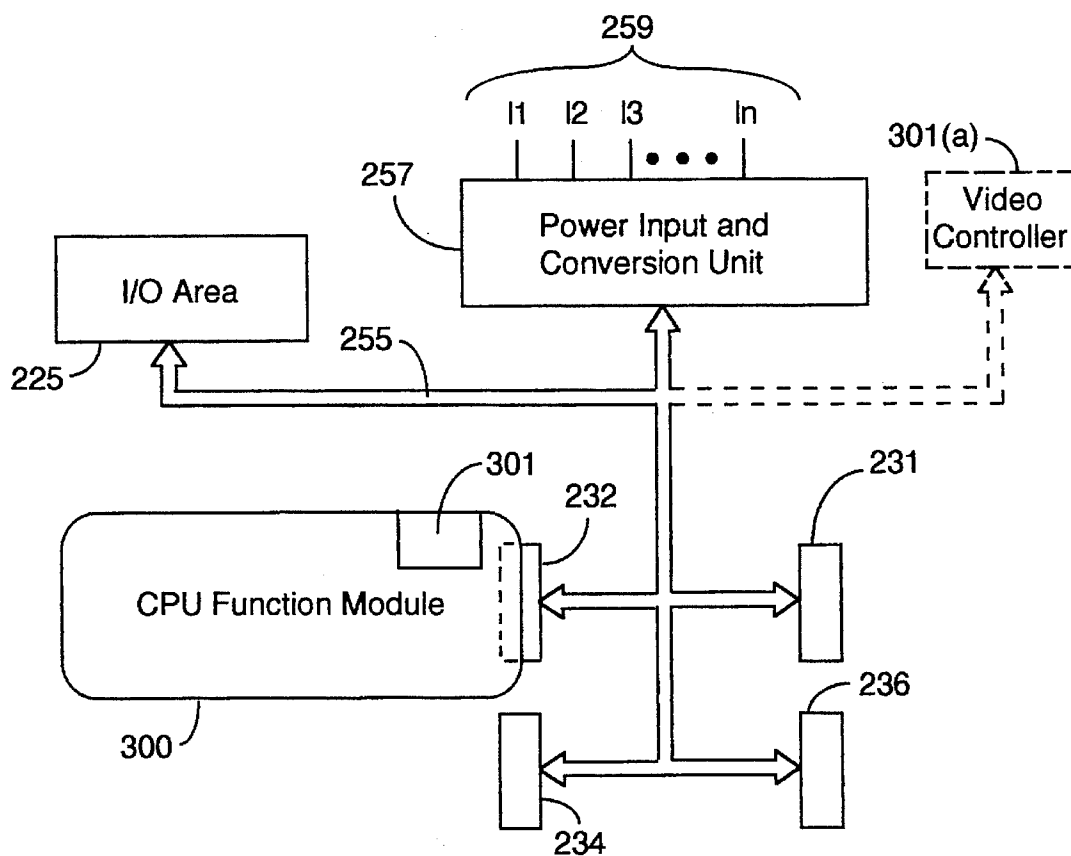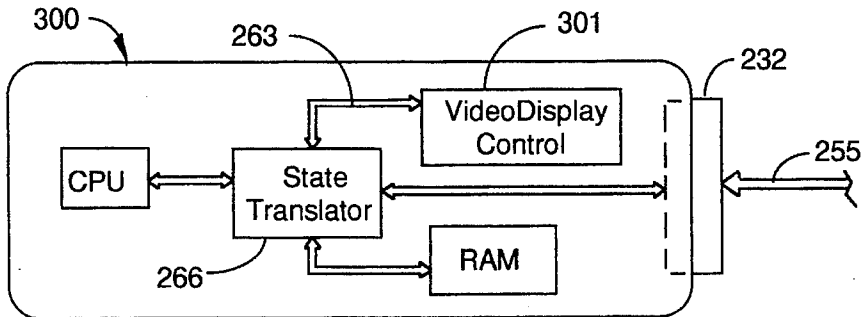
Fig. 16

Fig. 17

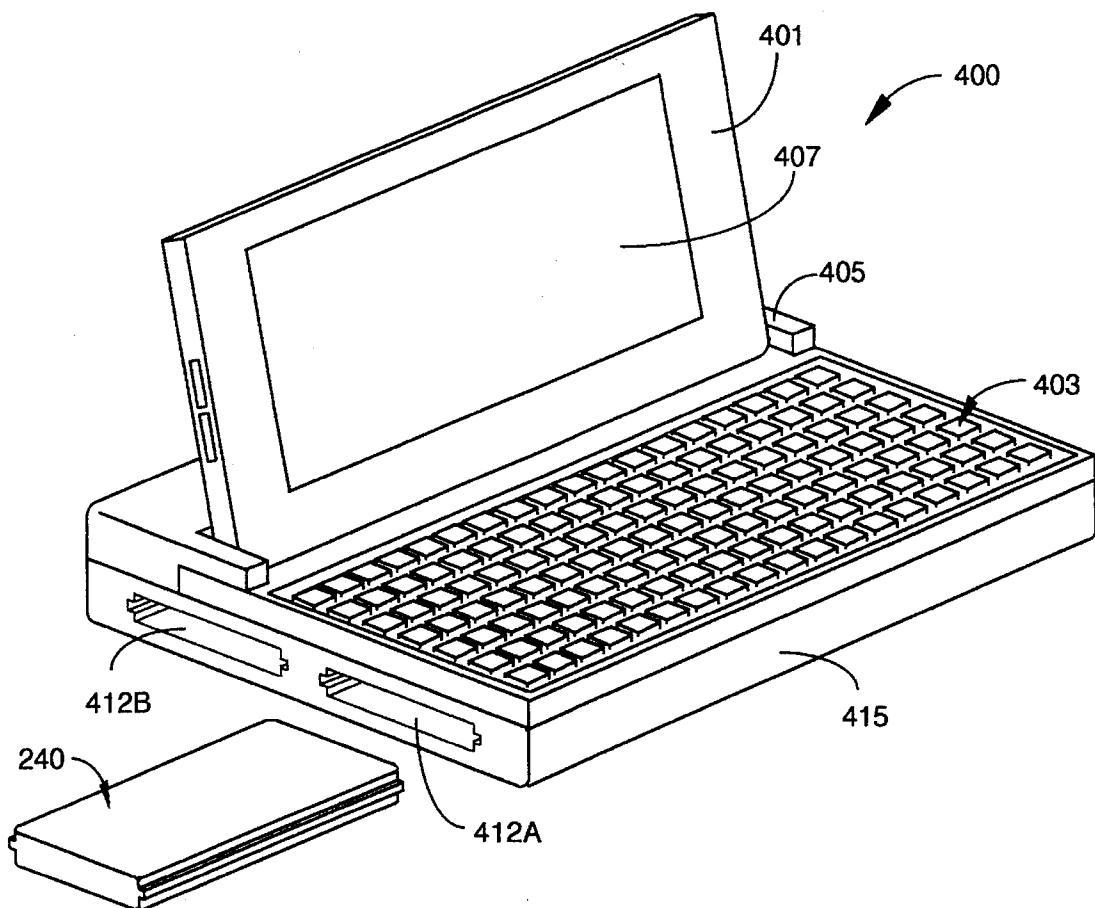Fig. 18



Fig. 19

Fig. 20



Fig. 21

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**1**

## MODULAR PORTABLE COMPUTER

### CROSS REFERENCE TO RELATED DOCUMENTS

This application is a continuation-in-part of application Ser. No. 08/097,946, filed Jul. 26, 1993, now issued as U.S. Pat. No. 5,278,730, which is continuation of application Ser. No. 07/905,480, filed Jun. 29, 1992, abandoned.

### FIELD OF THE INVENTION

The present invention is in the area of portable computer systems, and is particularly relevant to portable computers known as notebook, sub-notebook, and palmtop computers.

### BACKGROUND OF THE INVENTION

Portable computers are popular among computer users who travel and need to take their work along, and there is a tendency in the marketplace to smaller and smaller versions of portable computers. They are smaller and lighter than laptops, and are therefore more portable. The evolution to smaller and lighter portable computers, however, is not without problems. For one thing, smaller portable computers means less space for battery packs, which usually means shorter useful life between recharges. Another problem related to smaller size is a difficulty in providing versatility. Smaller size naturally means less space to provide a broad choice in peripheral devices and options.

Yet another problem is related to addresses and data byte size. State-of-the-art computers are capable of 32 bit addresses and 32 bit data words. A 32 bit computer, though, typically needs a bus structure with nearly 100 active signals, equating to high pin count and extensive device and component density. Such high density in a small computer creates many other problems, such as problems with heat dissipation. These are a few of the many problems in designing and developing portable computers.

What is needed is a new design for portable computers based on a bus structure allowing 32-bit capability with a minimum pin count, utilizing, for example, multiplexing of address and data on a single 32 bit structure, and utilizing only state-of-the-art technology to minimize power (hence buffer) requirements, which also minimizes heat and equipment complexity and density problems. Also, modularity needs to be raised to a new level by making virtually all components modular and "plug-in", including CPU's, power packs, anti all of the various known sorts of peripheral devices.

### SUMMARY OF THE INVENTION

In a preferred embodiment of the invention a modular computer is provided, comprising a case having contiguous walls, the case for supporting and enclosing elements of the modular computer; a plurality of separate module bays in a common plane, each module bay comprising a walled cavity in the case having an open outboard end and an inboard end closed by an end wall, wherein the walls of each cavity, including the end wall, comprise an extension of the contiguous walls of the case; a multi-pin electrical connector mounted through the inboard wall of each module bay; an internal bus within the contiguous walls of the case connected to each of the electrical connectors mounted through the inboard walls of the module bays; a display; and an input apparatus attached to the case substantially coplanar with the plane of the module bays.

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In one alternative embodiment the input apparatus is a keyboard, and the display is pivoted to close over the keyboard. In another alternative embodiment the display and the input apparatus comprise a touchscreen combination implemented on a surface of the enclosure. In some embodiments the docking bays have guides engaging guides of functional modules, and latching and expulsion apparatus to engage and expel functional modules.

In one preferred embodiment the input means is a keyboard, and the display is a flat panel display hinged to the support structure, and closable over the keyboard for storage and transport.

Functional modules are provided serving a wide variety of functions. One module comprises a CPU, which provides flexibility in CPU type and power, and upgradability as well. A CPU module may also incorporate random access memory and video display control. Function modules also are provided to enhance flexibility in input. Separate input devices, such as a full-size keyboard or a pen-based input tablet may be used with appropriate modules for receiving signals from the separate input devices and providing the signals to the internal bus. An input module for voice input, recognizing human speech, is also provided. Other function modules include Fax modems, telephone modems, floppy drives, hard disk drives, LAN communication modules, and data acquisition modules.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is an isometric view of a modular notebook computer framework according to an embodiment of the present invention.

FIG. 1B is a view of the computer framework of FIG. 1A from one side from the vantage of line 1B—1B on FIG. 1A.

FIG. 2 is a sectioned plan view of the computer framework of FIG. 1A taken according to section line 2—2 of FIG. 1B.

FIG. 3 is an isometric illustration showing a function module according to the present invention associated with a docking bay of the framework of FIG. 1A.

FIG. 4 is another view of a function module according to the present invention.

FIG. 5 is a block diagram of a compressed bus and connection to docking bays in a computer framework according to an embodiment of the present invention.

FIG. 6 is a block diagram of a CPU function module according to an embodiment of the present invention.

FIG. 7 is a block diagram of a power supply function module according to an embodiment of the present invention, with indication of connections to the internal bus structure and power conversion unit of the computer.

FIG. 8 is a block diagram of a floppy disk drive function module used in the invention.

FIG. 9 is a block diagram of a hard disk drive module used in an embodiment of the invention.

FIG. 10 is a block diagram of a "flash card" memory module according to an embodiment of the present invention.

FIG. 11 is a block diagram of a LAN module according to an embodiment of the present invention.

FIG. 12 is a block diagram of a modem module according to an embodiment of the present invention.

FIG. 13 is a block diagram of a FAX module according to an embodiment of the present invention.

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FIG. **14** is a block diagram of a data acquisition module according to an embodiment of the present invention.

FIG. **15A** is an isometric view of a modular palmtop computer framework according to an embodiment of the present invention.

FIG. **15B** is a view of the computer framework of FIG. **15A** from one side from the vantage of line **15B—15B** on FIG. **15A**.

FIG. **16** is a sectioned plan view of the computer framework of FIG. **15A** taken along section line **16—16** of FIG. **15B**.

FIG. **17** is an isometric illustration showing a function module and a dedicated docking bay in an embodiment of the present invention.

FIG. **18** is another view of a function module according to an embodiment of the present invention.

FIG. **19** is a block diagram of a compressed bus and connection to docking bays in a computer framework according to an embodiment of the present invention.

FIG. **20** is a block diagram of a CPU function module according to an embodiment of the present invention.

FIG. **21** is an isometric drawing of modular palmtop computer according to another embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

General Description

FIG. **1A** is an isometric drawing of a notebook computer framework **11** according to the invention. Framework **11** comprises a back housing **13**, a tilt-up flat panel display **15**, shown closed, a keyboard **17**, and a plurality of module bays for plugging in function modules. Back housing **13** includes a power unit for converting electrical input on a wide variety of standards to the form required by the computer. For example, there is a port (not shown) for connecting to a standard household outlet, rated at 120 V., 60 Hz, alternating current. The power unit will convert the input to outputs as needed by the computer bus and functional modules. There are also input ports for 6 V. DC, 12 V. DC, 9 V. DC, and others, and the power unit in one embodiment off the present invention is capable of recognizing the input characteristics by sampling, and switching to proper on-board circuitry to utilize the input.

In the embodiment shown by FIG. **1A** four module bays **19, 21, 23,** and **25** are shown along one side of the framework. There are four more module bays along the other side of the framework opposite the module bays shown. There could be more or fewer module bays, but eight is convenient and a good balance between the need to stay small and simple, and to also have adequate versatility.

FIG. **1B** is an end view of the notebook computer framework of FIG. **1** in the direction of arrows **1B—1B** of FIG. **1A**. Each of the module bays has a set of guide and positioning rails such as rails **27** and **29** in bay **19**. The rails are to position and guide a function module inserted into the module bay. Each rail in a set has a detent such as detent **31** for latching a module when the module is fully inserted in the bay. Each bay also has a connector such as connector **33** in bay **19**. The connectors are for coupling to a mating connector on a function module inserted in a bay. It will be apparent to a person with skill in the art that there are a number of equivalent ways guide rails, detents, and coupling may be accomplished.

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FIG. **2** is a plan section view just above the module bays taken along section line **2—2** of FIG. **1B**. Bays **19, 21, 23,** and **25** are shown on one side of the section view, and bays **35, 37, 39,** and **41** along the opposite side. A printed circuit board structure **57** is fastened in a substantially vertical position down the center of frame **59**, and connectors **33, 43, 45, 47.49, 51, 53,** and **55** are connected to the printed circuit board structure and present their pin structure outward toward the respective bay areas. In the presently described embodiment the internal connectors are male connectors, but this is not a requirement of the invention.

As also shown in FIG. **1A**, each module bay has a pair of opposed rails located vertically at about the midpoint of the height of the module bay. Rails **27** and **29** serve module bay **19**, and similar rails are located in each of the other module bays.

FIG. **3** is an isometric view of a function module **61** according to the invention aligned with module bay **25** of framework **11**. Module **61** includes guides **63** and **65** on opposite sides for engaging rails **67** and **69** when module **61** is inserted into bay **25**. The module has two spring-loaded detent levers (lever **73** is shown) for engaging detents in guide rails **67** and **69** when the module is fully inserted. Detent **71** is shown in rail **67** in FIG. **3**.

Each module bay has a compression spring mechanism engaged by a function module as the module nears full insertion, so there is an outward force on the module when the detent levers engage the detents. Mechanism **75** (FIG. **2**) is exemplary. To insert a module one aligns the guides in the module with the guide rails and pushes the module into the module bay until the detents engage. Button **79** on front face **77** of the module is for retracting the detent levers of the module, in which case the spring mechanism ejects the module, much as is the case with some floppy disk drives.

FIG. **4** is an isometric view of function module **61**, showing back face **81** opposite front face **77**. The back face includes a recessed female connector receptacle **83** in the preferred embodiment, for mating with male connectors positioned in each pod bay, such as connector **33** in FIG. **1B** and FIG. **2**. A second detent lever **74** is opposite lever **73** of FIG. **3**.

In the embodiment described above, and in many other embodiments, the notebook computer framework of the present invention comprises a frame with module bays and connectors as described above for "plugging in" function modules, power supply units, and other peripheral devices. The framework also comprises display **15**, keyboard **17**, and an internal bus structure hereinafter termed the Notebus, which is described in additional detail below, in the section titled "Notebus Bus Structure".

The function modules, as represented by module **61** in FIG. **3** and FIG. **4**, are provided in a wide variety of different models capable of a wide variety of different functions. For example, framework **11** has no "on-board" CPU, battery power, or system memory. These functions and all other functions are provided by different models of function modules which may be inserted in any one or a combination of the available module bays. Other kinds of function modules that may be inserted include floppy-disk drives, hard-disk drives, "flashcard" memory modules, LAN and modem adapters, Fax modules, speciality modules such as data acquisition modules adapted to specific equipment, and more. The function modules are also described in more detail in the section below titled "Function Modules".

Electronic Architecture

FIG. **5** is a block diagram showing internal elements of Notebook computer framework **11**, connected to show the

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**5**

electronic architecture of the notebook computer according to the invention. Power input and conversion unit **85** is housed in back housing **13** (FIG. **1**) and has ports **87** for power inputs. Unit **85** senses the input conditions and selects appropriate circuitry to convert the input to the voltages needed to power the other elements of the system. Output from the conversion unit is to Notebus **89**, which comprises paths for power as well as for digital information such as data and addresses.

Because there are a wide variety of function modules, as indicated above and described in more detail below, there needs typically to be more than one power line in the Notebus. For example, the notebook computer of the invention comprises hard disk drive modules, and these modules are preferably provided without their own "on board" power source. The motor drive for the hard disk requires a different power (voltage and current) than does a CPU, for example, so there are parallel power lines of differing size and voltage level in the notebus. A typical Notebus will have, for example, a line for 24 V DC, another for 12 V DC, and yet another for 5 V DC, as well as multiple ground lines.

Notebus **89** connects to a video display controller **91** including Video Random Access Memory (VRAM) which both powers and controls display **15**, which in the preferred embodiment is a flat panel display driven by analog driver lines on analog bus **93**. Notebus **89** also connects to a keyboard controller **95** which powers and controls keyboard **17** over link **97**, accepting keystroke input and converting the input to digital data for transmission on Notebus **89**. The keyboard controller may be physically mounted in the keyboard or in framework **11**.

Notebus **89** also connects as illustrated in FIG. **5** to each of the module bays, such as bay **19**, through connectors, such as connector **33**. When a function module, such as module **61**, is inserted into a module bay, the mating connector in the back of the function module mates with the connector from the Notebus, and circuitry inside the function module is then connected to the Notebus.

Notebus Bus Structure

The Notebus comprises, as stated above, both power and data paths. The digital lines are capable of carrying 32 addresses and conveying data in 32 bit word length. To minimize pin count and routing complexity, addresses and data are multiplexed on a single set of 32 traces in the overall bus structure. One with skill in the art will recognize that this type of bus is what is known in the art as a low-pin-count or compressed bus. In this kind of bus different types of signals, such as address and data signals, share signal paths through multiplexing. For example, the same set of data lines are used to carry both 32-bit addresses and data words of 32-bit length.

In the Notebus of the present invention, some control signals, such as interrupt arbitration signals, may also share the data lines. Typical examples of buses that are exemplary as usable for the Notebus (with the exception of power supply analog lines in the Notebus) are the "S-Bus" implemented by Sun Microsystems, the "Turbochannel" Bus from Digital Equipment Corporation, and buses compatible with the IEEE-488 standard.

The Notebus is a high-speed backplane bus for interconnecting processor, memory and peripheral device modules. The Notebus also supplies standard operating and standby power supply voltages and electrical ground to all module bays.

Function Modules

FIG. **3** and FIG. **4** show, as described above, two different views of a function module according to the present inven-

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tion. Also as stated above, function modules may have many different functions. There are as many different functions, in fact, as there are possibilities for discrete peripheral devices, plus power and CPU modules. An individual function module is provided for each function, and in each case the function module has a physical size and form compatible with the bays, guide rails, and connectors for "plugging in" to framework **11**.

The "face" of a function module, being the exposed face when the module is "plugged in" (see face **77** in FIG. **3**) may have elements specific to the type of module. For example, a CPU module may have no indicators or other elements on the front face, while a floppy disc module will typically have an opening for inserting a floppy disk and a "key" or button for releasing and ejecting the floppy disk.

A unique feature of the present invention is that the CPU for the notebook computer is provided as a CPU function module. This provides an ability for a user to tailor the CPU power to the other modules and application for the notebook computer, and an easy upgrade to more powerful CPUs.

FIG. **6** is a diagram of a CPU module **99** plugged into a bay in a notebook computer according to the present invention. In this case (referring to FIG. **2**) the module is plugged into bay **19** having connector **33**. This is exemplary, as the module could just as well be plugged into any open bay of framework **11**. By virtue of being plugged into connector **33** or another module connector, internal elements of the CPU module are connected to Notebus **89**.

The internal elements for module **99** comprise CPU **103**, a state translator **105**, and RAM memory **113**. CPU **103** may be any of a wide variety of CPUs (also called in some cases MPUs) available in the art, for example Intel 80386 or 80486 models. MIPS, RISC implementations, and many others. CPU **103** communicates with State Translator **105** over paths **107**, and State Translator **105** communicates with connector **33**, hence Notebus **89**, over bus **109** internal to the module, which is an extension of bus **89** when the module is plugged into bus **89**.

State translator **105** is a chip or chip set designed to translate commands and requests of the CPU to commands and requests compatible with the Notebus. It was mentioned above that CPU **103** may be one of a wide variety of CPUs, and that. Notebus **89** may be any one of a wide variety of compressed buses. It will be apparent to one with skill in the art that there may be an even wider variety of state translators **105** for translating between the CPU and the Notebus. The state translator is theoretically a different device for each possible combination of CPU and Notebus.

RAM memory module **113** comprises conventional RAM chips mounted on a PCB as is known in the art, and connectable to state translator **105** by a plug or connector interface, such as an edge connector. The purpose of having a RAM module "on board" the CPU module is to provide for rapid memory access, which will be much slower if the RAM is made available in a separate module at one of the other module bays. Memory at another module bay is on the Notebus, and will be subject to bus contention and wait states. The plug-in nature of the RAM unit relative to the CPU module allows different amounts of memory to be provided with a CPU module in the notebook computer of the present invention.

As described above, Notebus **89** comprises not only the shared data and address lines, but also power and ground connections for the modules plugged into the various bays. Paths **109** and **107** therefore comprise power and ground lines for CPU **103** and Translator **105**.

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If, for example, CPU **103** is an INTEL 80486 microprocessor, State Translator **105** will be a translator for accommodating the state machine of the 80486 to the state machine of the Notebus, which may be any one of the buses described above for bus **89**, or another compressed bus. There are many equivalent ways a translator may be implemented for the specific case. Given the manufacturers available design information for the CPU and the equivalent information for bus **89**, it is within the skill of workers in the art without undue experimentation to implement the translator and the required connections. This is conventional technology. The implementation of the translator on a module with a CPU to plug into a module bay in the notebook computer is unique to the present invention.

In the invention, state translators may be implemented in a single chip set or circuitry set to be capable of translating between a number of CPUs and a number of different bus possibilities. One might, for example, design and implement a translator with the necessary circuitry and intelligence to translate between three different CPUs and three different compressed buses. The state translator could be made hardware or software programmable to select one CPU and one bus from the available selections at some convenient time in the manufacturing cycle, or even at the time of selection of modules to make up a notebook computer.

As an example of a hardware programmable translator, a translator could be built to have certain traces cut as a near final step in manufacture as a way of selecting the CPU and bus pair. Translators could also be programmable by virtue of on-board EPROM or EEPROM devices. As an example of software programmability, translators could be implemented with microprocessor technology and software programmable. A CPU module could be plugged into a connector on a special programming unit, for example, before installation in a notebook computer according to the present invention, and be sent certain commands to set up on board software to translate between the desired CPU and bus. It will be apparent to one with skill in the art that there are many possible variations in the implementation of the translators.

FIG. **7** shows a power module **111** plugged into a bay in the notebook computer according to an embodiment of the present invention. The purpose of a power module is to provide a source of power for the computer, which includes any modules plugged into the module bays. As is common in notebook computers in the art, there may be a battery, typically rechargeable, in framework **11**, and the battery may also be replaceable and rechargeable through power input lines **87**. In the case of an on-board battery pack, there is the option of using all module bays for other than power packs.

Preferably framework **11**, sans function modules, has no power capability other than power plugged into one of input lines **87**, which may be converted to the power characteristics needed by the computer and distributed on the power lines of the Notebus. For portability, power is typically supplied by one (or more) power modules **111** plugged into one or more of the module bays.

Module **111** has a battery pack **101** which is connected via lines **117** to (in this case for example) connector **33**, and hence to Notebus **89**. Because there are several supply lines in the Notebus for supplying power to function modules at different voltage and with different current capability, the power lines in the Notebus For connecting a power module **111** are not the same as the lines for supplying power to a module. There is instead a separate sat of power lines to pins on the module bay connectors, such as connector **33**, which

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connect as input, to power input and conversion unit **85**, much as do input ports **87**.

In FIG. **7**, lines **119** and **121** connect power module **11** to conversion unit **85**, where the power input from the power module is sensed and treated as a power source, much as is done for power input lines **87**. This power is converted to the needed voltages and current capabilities, and put back out on the power supply output lines to the module bays. In FIG. **7** line **119** is ground, and arrow **123** represents all of the data/address, control, and power output lines to the module bays. Lines represented by arrow **123**, plus lines **119** and **121** are Notebus **89**. Although not shown in FIG. **7**, there are connections for line **119** and for line **121** to each of the module bay connectors.

Power modules such as module **111** may be plugged into a connector on a charging module separate from the notebook computer, using the same connector used for plugging into the Notebus via a module bay of framework **11**, and recharged for later use with a modular notebook computer according to the invention. This allows a user to keep spare power modules ready for use, and to recharge modules without connecting the computer itself to a charging unit. Moreover, the provision of power modules allows a user to provide more or less portable time to the notebook computer by using one or more than one power module.

FIG. **8** shows a floppy disk drive (FDD) module **125** plugged into a module bay in a notebook computer according to an embodiment of the present invention. Module **125** comprises a conventional FDD unit **129** for nominal 3.5 inch disks with conventional circuitry mounted in a case **130** to provide a module with guides, latches, and a connector matable with connector **35** to be able to plug into a module bay in the notebook computer of the present invention. The case comprises an opening **131** for inserting and withdrawing a floppy disk, and an eject button **133** for ejecting a floppy disk.

A controller **127** communicates with unit **129** over lines **126** and with connector **33** (hence Notebus **89**) over lines **128**. The unit also derives power from the appropriate pins on connector **33**, but these pins and lines are not shown. Controller **127** is an ASIC chip or chip set for translating between the notebus and the FDD unit. Given the data storage standards of the FDD unit and the characteristics of bus **89**, it is within the scope of workers with ordinary skill in the art to implement controller **127** without undo experimentation.

FIG. **9** shows a hard disk drive (HDD) module **135** according to an embodiment of the present invention plugged into bus **89** in a module bay of framework **11**. HDD module **135** comprises a conventional HDD unit **139** mounted in a case **137** to be compatible with plugging into a notebook computer according to the present invention. As in the case of the FDD module described above, a controller **141** is provided to translate between Notebus **89** and the HDD unit. Controller **141** communicates with HDD unit **139** over lines **143**, and with connector **33** over lines **145**. Connector **33** is exemplary of any one of the module connectors in the notebook computer.

Given the characteristics of HDD unit **139** and of Notebus **89**, it is within the skill of workers in the art to implement controller **141** without undue experimentation. Power line connections are not shown. In implementing controller **141** there are several protocols that may be used. One is the ST506 standard known in the art. Another is the IDE standard known in the art. Yet another is an enhanced IDE, called EIDE, known to the inventors, and the subject of a

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separate patent application to be filed. In the EIDE protocol, there may be multiple IDE devices daisy-chained and addressed as secondary IDE devices with an additional select number.

FIG. 10 shows a "flash card" memory module 147 plugged into connector 33 of the notebook computer of the invention. "Flash cards" are RAM memory cards known in the art pluggable into typically parallel ports o make connection with internal bus structures of a computer. Module 147 comprises a conventional "flash card" 151 mounted in a case 149 compatible with the module bay of a notebook computer according to the present invention.

As in cases described above, a controller 153 is needed to accomplish communication between the memory structure of the "flash card" and bus 89. Controller 153 communicates with "flash card" unit 151 over lines 155 and with connector 33 over lines 157. There may optionally be an opening 159 in case 149 and a connector (not shown) within unit 151 for inserting and withdrawing flash cards, so relatively large collections of data may be plugged in as desired. Alternatively the interface may be the modular interface afforded by the plug-in module 147. Again, given the known characteristics of the flash card and of bus 89, implementation of the controller is a matter within the skill of workers in the art.

FIG. 11 shows a LAN module 161 plugged into connector 33 of a notebook completer according to an embodiment of the present invention. In the embodiment shown in FIG. 11 a conventional LAN card, such as an Ethernet card, is mounted in a case 163 to be compatible with plugging into a module bay of a notebook computer according to an embodiment of the present invention.

LAN card 167 communicates with a conventional connector 165 in the face of the case of module 161 that, is exposed when the module is plugged into a bay. This is a conventional connector of the sort known in the art for connecting computers on a network.

Within module 161, in a first, alternative, conventional LAN card 167 interfaces to a controller 169 communicating over lines 171 and 173, and the controller translates between bus 89 and the conventional LAN card. In a second alternative, a LAN card is provided with the translation built in, so no separate controller is needed. The first alternative is preferable.

FIG. 12 shows a modem module 175 plugged into connector 33 in a bay of a notebook computer according to an embodiment of the present invention. Modem module 175 comprises a conventional modem card 181 mounted in a case 177 to be compatible with plugging into a module bay. In this case, and other cases above, where the term "conventional" is used in conjunction with a card or unit, it is meant that the circuitry and function is conventional. The size may be adjusted to be compatible with a module case for plugging into a bay of a notebook computer according to the present invention.

Modem card 181 connects over lines 183 to a telephone interface 179, which may comprise more than one "jack" so a hand set may also be connected. Card 181 communicates to Notebus 89 over lines 187 and 189 through controller 185, which translates between the conventional card and the compressed bus. Alternatively, the translation components may he implemented on a single card along with the modem circuitry.

FIG. 13 shows a FAX module 191 plugged into connector 33 of a module bay in an embodiment of the present invention. Module 191 comprises a conventional FAX card 199 mounted in a case 193 to be compatible with plugging

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into a module bay in the present invention. Fax card 199 communicates over lines 197 with a telephone interface 195, which may, as in the case of the modem module described above, have more than a single telephone "jack".

A controller 201 provides an interface for the conventional FAX card between the card and Notebus 89 over lines 203 and 205. Alternatively, the controller may be implemented on the same card as the FAX circuitry. In yet another alternative, the FAX capability and the modem capability described above may be implemented into a single module.

FIG. 14 shows a specialty data acquisition module 207 plugged into connector 33 in a module bay in a notebook computer according to an embodiment of the present invention. Module 207 comprises a circuit card 215 mounted in a case 209 to be compatible with plugging into a module bay. Card 215 communicates over lines 213 to an interface 211 which may comprise one or several acquisition leads for connecting to outside equipment. For example, a data module may be provided For following the output of the vertical and horizontal sweep of an oscilloscope, and would have at least two input leads; one for the vertical and one for the horizontal sweep.

Card 215 communicates over lines 217 to connector 33, hence Notebus 89. The circuitry on card 215 is designed to digitize the input if the input is analog, and to be compatible with Notebus 89. Given the characteristics of signals to be measured and the characteristics of Notebus 89, implementation of such a card is within the ordinary skill in the art.

The embodiments of the present invention described above relate primarily to notebook type computers. However, the invention has broader applications. The principles of the invention are also applicable to portable computers known as palmtop computers, and further embodiments are described below.

FIG. 15A is an isometric view of a modular palmtop computer 221 according to an embodiment of the invention. Computer 221 is approximately the size of one-half a standard piece of paper (approximately 5.5 inches by 8.5 inches) and in a preferred embodiment comprises a planar array of four Personal Computer Memory Card International Association (PCMCIA) Type II module bays in a case 223.

In this embodiment case 223 has a combination I/O area 225 implemented on one side of computer 221, comprising a display overlaid with a touch sensitive planar structure. In other embodiments, the display may be a flat-panel display pivoted to the case, or a separate monitor in communication with case 223. The touch screen provides a "softkey" operation in conjunction with interactive control logic. In a preferred embodiment of the invention, the control logic resides in static or dynamic memory within case 223 but may also be part of an installed PCMCIA-type peripheral. A power unit (not shown) is enclosed within case 223 for converting electrical input on a wide variety of standards to the form required by the computer. For example, there is a port (not shown) for connecting to a standard household outlet, rated at 120 V., 60 Hz, alternating current. The power unit converts the input to outputs as needed by the computer bus and function modules. There are also input ports for 6 V. DC, 12 V. DC, 9 V. DC, and others, and the power unit in one embodiment of the present invention is capable of recognizing the input characteristics by sampling, and switching to proper onboard circuitry to utilize the input.

in the embodiment of the invention shown by FIG. 15A, two module bays 227 and 229 are provided on one side of case 223. There are two more module bays along the other side of the case opposite the module bays shown. In other

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embodiments bays may open to other edges of the case. The configuration provides a good balance between the need to stay small and simple, and to also have adequate versatility. In alternative embodiments other module configurations may be used, such as PCMCIA Type III, and others. In the alternative configurations the arrangement of the planar array of modules may vary as well.

FIG. 15B is a view of computer 221 in the direction of arrows 15B—15B of FIG. 15A. I/O area 225 is located on top of case 223. Module bay 227 has a set of guide slots 230A and 230B. The guide slots are to position and guide a PCMCIA module card inserted into the module bay. Each module bay in this embodiment is configured to PCMCIA dimensional and connective standards and secures the fitted PCMCIA cards according to those standards. In this embodiment of the present invention, case 223 has bays configured to PCMCIA type 2, revision B standard. In another embodiment of the invention, the case may have other types of PCMCIA module bays, or bays configured to one or another proprietary standard.

Each module bay has a bus connector, such as connector 231. In this embodiment, connector 231 is a standard PCMCIA connector that accepts PCMCIA cards and is electrically connected to the palmtop's internal bus. It will be apparent to those with skill in the art that there are a number of equivalent ways to connect a function module.

FIG. 16 is a simplified plan sectional view of computer 221 taken according to section line 16—16 of FIG. 15B. Frame 228 frames four PCMCIA module bays 222,224, 227 and 229 arranged in a planar array. A printed circuit board structure 235 is fastened and positioned down the center of frame 228, and connectors 231,232, 234 and 236 are connected to the printed circuit board structure and present their pin structure outward toward the respective bay areas. In the presently described embodiment, the internal connectors are male connectors, but this is not a requirement of the invention.

Slots 230A and 230B serve to guide a PCMCIA-type card into module bay 227, and similar slots are located in each of the other module bays shown as dotted lines in the sectional view. A set of three AA batteries 237 are located generally in the plane of the module bays and provide a portable power means in one embodiment. In another embodiment, outside power sources may power computer 221 as described above.

FIG. 17 is a partial isometric view of a function module 240 according to an embodiment the invention, aligned with module bay 227 of computer 221. Arrow 241 shows the direction of insertion of the function module. I/0 area 225 is implemented on top of case 223 in a plane parallel with the plane of the module bays. Module 240 is a Type 2 PCMCIA card and has a thickness D1. The opening of module bay 227 has width W1 and height H1. The length of function module 240 is L1. In this embodiment of the present invention, these dimensions conform to PCMCIA industry standards. In an alternative embodiment of the present invention, module bay 227 may change in dimension to accommodate other standard or proprietary modules.

Module bay 227 engages function module 240 in the full inserted position according to PCMCIA standards. In another embodiment of the invention, detents may be provided similar to those in FIG. 3 for the larger notebook computer embodiment. There are a number of ways known in the art to position and secure a small module. Securing a module may also be accomplished by other means, such as clamping or wedging and/or closing retaining mechanisms.

FIG. 18 is an enlarged isometric view of function module 240 according to Type 2 PCMCIA standards. Back face 252

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includes a female connector 253 for mating with a male connector positioned in each module bay, such as connector 231 in FIG. 15B and FIG. 16. Connectors 231 and 253 are PCMCIA connectors and interface according to that industrial standard. Guide 251A and 251B are sized according to the PCMCIA standards.

Function modules are provided in many models capable of a wide range of functions. For example, computer 221 in one embodiment has no onboard CPU or system memory. These functions are provided by function modules that may be inserted in any one of the available module bays. Other kinds of function modules that may be inserted include I/O system modules that provide speech-based, pen-based or keyboard based input. There are also floppy-disk drives, hard-disk drives, flashcard memory modules, LAN and modem adapters, Fax modules, specialty modules such as data acquisition modules adapted to specific equipment, specialty video modules, modules to adapt scanner periherals to the computer, telephone adapters, and more. In the case of I/O modules, necessary software, and in some cases firmware and hardware, may be connected to the internal bus structure by the insertion of a module. For example, a module is provided in one embodiment comprising an induction coil and a controller for decoding signals received via a varying magnetic field and providing code to the computer's internal bus. The varying magnetic field is produced by a stand-alone keyboard wherein the keystrokes are coded and transmitted as signals on the field.

In another embodiment, a similar module provides for communication from an auxiliary pen-based input pad. In yet another embodiment, a plug-in nodule provides a microphone, DSP circuitry, and necessary software to accept input from a user by voice, and to convert the voice input to machine-readable code. Provision of the necessary software and circuitry in these instances in module form provides for maximum flexibility an upgradability for modular systems according to the invention.

Electronic Architecture

FIG. 19 is a block diagram showing internal elements of palmtop computer 221, connected to show the electronic architecture of the modular computer according to an embodiment of the invention. A power input and/or conversion unit 257 is housed in case 223 (FIG. 15A) and has ports 259 for power inputs. Power input may be from AA batteries 237 (FIG. 16) or from an optional conversion unit via outside electrical sources. Conversion unit 257 senses the input conditions and selects appropriate circuitry to convert the input to the voltages needed to power the elements of the system. Output from the conversion unit is to bus 255, which comprises paths for power as well as for digital information such as data and addresses.

Because there are a wide variety of function modules, as indicated above and described in more detail below, there needs typically to be more than one power line in bus 255. For example, computer 221 may utilize hard disk drive modules, and these modules are preferably provided without onboard power sources. The motor drive for a hard disk requires a different power configuration (voltage and current) than does a CPU, for example, so there may be parallel power lines of differing size and voltage level in bus 255. Bus 255 may have a line for 24 V PC, another for 12 V DC, and yet another for 5 V DC, as well as perhaps multiple ground lines.

Bus 255 connects I/O area 225 and transmits video signals from a video controller. The video controller may be integral to a function module, which is shown as video controller 301

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in a CPU function module **300**, or implemented in the case, shown as optional video controller **301**(a). As described above in a preferred embodiment of the present invention, I/O area **225** is a combination display with an overlaid touch sensitive screen. In another aspect, the I/O area may comprise an active-matrix display, in which case, dedicated analog driver lines from video controller **301** connect to the display. I/O area **225** may also comprise a conventional LCD display wherein I/O control logic is a function of an installed and dedicated I/O peripheral modules. In an alternative embodiment, video controller **301** is built into case **223** (FIG. **15**A), and connected directly to bus **255**, similar to the modular notebook computer described above.

Bus **255** connects to each of module bays **222, 224, 226** and **227** (FIG. **16**) through connectors **232, 234, 236** and **231**. When a function module, such as CPU module **300**, is inserted into a module bay, female connector **253** (FIG. **18**) mates with the respective male connector **232** located in that module bay, and circuitry inside the CPU module is then connected to bus **255**.

Palmtop Function CPU Module

The onboard video controller **301** built into CPU function module **300** is a unique feature in one aspect of the present invention. A user is provided an ability to tailor the CPU power and type of video controller to the other modules and applications for palmtop computer **221**. This provides a simple means for upgrading by switching CPU function modules. Video signals are local to the CPU, which increases system performance.

FIG. **20** is a more detailed diagram of CPU module **300** for computer **221**. CPU module **300** is similar in function to CPU module **99** (FIG. **6**), except for the addition of video controller **301**. Onboard video controller **301** is bus connected by line **263** to a state translator **266**. In this embodiment of the invention, the state translator is configured to transmit and receive video signals and commands over bus **255** via connector **231** as well as other functions as described above.

Other Aspects and Features

The embodiments of the present invention described above specifically address notebook-type and palmtop-type computers. The embodiment described below addresses yet another aspect of the palmtop type computers.

FIG. **21** is an isometric drawing of another embodiment of the present invention. Computer **400** comprises an attached pivotable display case **401** and a fixed keyboard **403**. The display case rotates about a hinge **405** and closes in a fixed detented position above the keyboard. Display case **401** comprises a flat-panel display **407**. There are two PCMCIA-type module bays **412**A and **412**B on one side of the case, and two more (not shown) on the side opposite. The four PCMCIA module bays are arranged in a planar array as described above. A frame **415** contains a bus structure (not shown) that interconnects all aspects of the PCMCIA type module bays to computer **400** as described above. In this embodiment of the present invention, a standard keyboard controller (not shown) enclosed in frame **415** connects keyboard **403** to the internal bus structure.

It will be evident to one with skill in the art that there are many changes that might be made without departing from the spirit and scope of the invention. Many of these alternatives have been described above. For example, there may be more than the four module bays described, or fewer. There may also be more than one planar array of module bays. To provide more docking bays in a compact arrangement, one might provide two or more planar levels, with multiple docking bays in each plane. Similarly, there are many ways modules may be built to be docked in a framework such as computer **11, 221** and **400** to form a planar array. There are similarly many different kinds of connectors that might be utilized as well as many kinds of compressed buses that can be used. There are many kinds of modules that may be provided, and many other changes that might be made within the spirit and scope of the invention.

What is claimed is:

1. A modular computer comprising:

a case having contiguous walls, the case for supporting and enclosing elements of the modular computer;

a plurality of separate module bays in a common plane, each module bay comprising a walled cavity in the case having an open outboard end and an inboard end closed by an end wall, wherein the walls of each cavity, including the end wall, comprise an extension of the contiguous walls of the case;

a multi-pin electrical connector mounted through the inboard wall of each module bay;

an internal bus within the contiguous walls of the case connected to each of the electrical connectors mounted through the inboard walls of the module bays;

a display; and

an input apparatus attached to the case substantially coplanar with the plane of the module bays.

2. A modular computer as in claim **1** wherein each module bay is sized to receive within the cavity and dock a functional module, and wherein each module bay has guides for engaging mating guides on a functional module.

3. A modular computer as in claim **1** wherein the input apparatus is a keyboard and the display is a flat-panel display pivoted to the case and closable over the keyboard for storage and transport.

4. A modular computer as in claim **1** wherein the internal bus is a compressed bus for multiplexing data and addresses on a common set of conductors.

5. A modular computer as in claim **1** wherein the module bays open to two opposite edges of the case, and the internal bus is implemented in a central spine between the inboard walls of opposite module bays.

6. A modular computer as in claim **5** comprising four module bays, two module bays opening to each of the opposite edges of the case.

7. A modular computer as in claim **1** wherein the module bays open to adjacent edges of the case.

8. A modular computer as in claim **1** further comprising a CPU function module having a CPU microprocessor, wherein, upon docking, the CPU microprocessor becomes the CPU of the modular computer.

9. A modular computer as in claim **8** further comprising a video controller and a random access memory connected to the CPU microprocessor.

10. A modular computer as in claim **1** further comprising an input control function module configured for receiving input signals from a separate input apparatus.

11. A modular computer as in claim **10** wherein the separate input apparatus is a keyboard, and the input function module is configured to receive keystroke signals from the keyboard and to communicate the keystroke signals to the internal bus.

12. A modular computer as in claim **10** wherein the input function module is configured to receive input signals from a pen-pad separate input device, and to transmit the input signals to the internal bus.

13. A modular computer as in claim **10** wherein the input function module comprises a microphone and a digital

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signal processor for receiving voice input, converting the voice input to computer-operable code, and transmitting the computer operable code to the internal bus.

**14**. A modular computer as in claim **1** further comprising an input/output control function module, the input/output

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control function module configured as one of a serial telephone modem, a LAN modem, a floppy disk drive, a hard disk drive, a FAX modem, and a data acquisition modem.

\*   \*   \*   \*   \*